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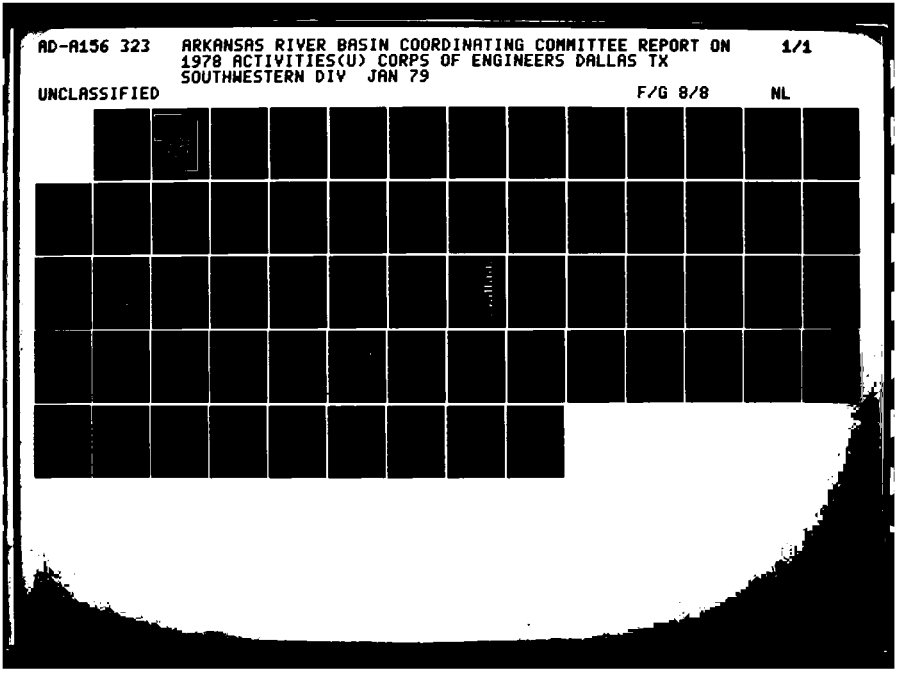

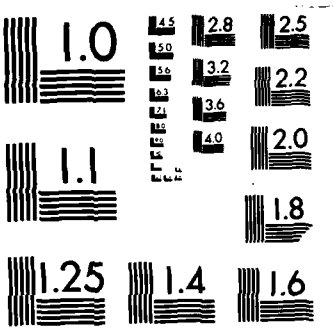

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Report on 1978 Activities

ARKANSAS RIVER BASIN COORDINATING COMMITTEE

U.S. ARMY CORPS OF ENGINEERS
SOUTHWESTERN DIVISION
Reservoir Control Center

JANUARY 1979

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

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The Arkansas River Basin Coordination Committee consists of official representatives of the following State and Federal agencies--States: Kansas, Oklahoma and Arkansas. Federal: Corps of Engineers, Department of the Interior, Federal Power Commission, Soil Conservation Service and Southwestern Power Administration.

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

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20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report is prepared in January of each year to summarize the actual regulation of the Arkansas River Basin reservoirs and navigation system for the previous calendar year. It provides members historical data to use in appraising the results of the past year's regulation and can be used in communicating with their agencies. The report also contains a general summary of planned activities for the coming year.

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STATES

Kansas

Oklahoma

Arkansas

FEDERAL

Corps of Engineers

Department of the Interior

Environmental Protection Agency

Federal Power Commission

Soil Conservation Service

Southwestern Power Administration

ARKANSAS RIVER BASIN COORDINATING COMMITTEE
REPORT ON 1978 ACTIVITIES

PLATES

EXHIBITS

ARKANSAS RIVER BASIN COORDINATING COMMITTEE
REPORT ON 1978 ACTIVITIES

I. PURPOSE AND SCOPE

The Arkansas River Basin Coordinating Committee was organized on 20 March 1970. The purpose of this committee is to provide coordination between state and Federal agencies in the regulation of the water resources of the Arkansas River Basin downstream from Great Bend, Kansas. The Committee requested that a report be prepared each calendar year to provide a summary of the regulation activities for the past year.

The report, prepared in January of each year, summarizes the actual regulation of the Arkansas River Basin reservoirs and navigation system for the previous calendar year. It provides members historical data to use in appraising the results of the past year's regulation and can be used in communicating with their agencies. The report also contains a general summary of planned activities for the coming year.

II. INTRODUCTION

A. The Basin. The Arkansas River Basin has a drainage area of 160,533 square miles above the mouth of the White River. From its source on the eastern face of the Rocky Mountains near Leadville, Colorado, the Arkansas River flows southeasterly through Colorado, Kansas, Oklahoma, and Arkansas, to join the Mississippi River at a point about 575 miles upstream from the head of Passes, Louisiana. From its source at about elevation 14,000 feet, msl, the fall of the river ranges from 110 feet per mile near Leadville, Colorado, to 2.2 feet per mile at Tulsa, Oklahoma, and 0.4 foot per mile near the mouth. Major tributaries of the Arkansas River are the Salt Fork of the Arkansas, Cimmaron, Verdigris, Grand (Neosho), Illinois, Canadian, Poteau, Petit Jean, and Fourche La Fave Rivers. Plate 1 shows the basin and location of the existing projects.

The upper portion of the basin in Colorado is mountainous and the stream flows through deep gorges and narrow valleys with steep gradients. Below Pueblo, Colorado, the valleys begin to widen and the gradient decreases. Below Great Bend, Kansas (river mile 873.2), the river is crooked and subject to shifting channels. Below the mouth of the Verdigris River, the bank stabilization and channel rectification works now provide a stable channel, suitable for modern barge traffic. Former river channels can be seen several miles from the present stabilized river channels.

The mean annual precipitation ranges from 15 inches in the western portion of the basin to 52 inches at the mouth. The greatest amount of precipitation occurs in late spring and early summer in the western portion of the basin and in late winter and early spring in the eastern portion of the basin. The normal precipitation for selected stations is shown in table 1. The mean annual snowfall ranges from 21 inches near Dodge City, Kansas, to 3 inches in the eastern portion of the basin.

TABLE 1

NORMAL PRECIPITATION

(1941-1970)

	DODGE CITY, KS	WICHITA KS	TULSA OK	FORT SMITH AR	LITTLE ROCK AR
January	0.50	0.85	1.43	2.38	4.24
February	0.63	0.97	1.72	3.20	4.42
March	1.13	1.78	2.52	3.64	4.93
April	1.71	2.95	4.17	4.74	5.25
May	3.13	3.60	5.11	5.48	5.30
June	3.34	4.49	4.69	3.93	3.50
July	3.08	4.35	3.51	3.24	3.38
August	2.64	3.10	2.95	2.91	3.01
September	1.67	3.69	4.07	3.31	3.55
October	1.65	2.50	3.22	3.47	2.99
November	0.59	1.17	1.87	3.08	3.86
December	0.51	1.12	1.64	2.89	4.09
Annual	20.58	30.58	36.90	42.27	48.52

The average annual runoff varies from less than 0.5 inch in the western plains to 18 inches in central Arkansas. Floods occur more frequently during spring months, but records show that large floods may occur at anytime during the year. The recorded flows at Little Rock have ranged from a low of 850 cfs on 23 August 1934 to a high of 536,000 cfs on 27 May 1943. The average recorded flow at Little Rock for a 51-year period ending 30 September 1978 is 41,000 cfs (29,670,000 acre-feet per year).

B. Development. Federal development of the Arkansas River Basin water resources downstream from Great Bend, Kansas, began with the 1936 Flood Control Act (P.L. 738, 74th Congress). A comprehensive report of possible plans of development of the Arkansas River and tributaries for flood control and other uses was published in 1936 as House Document No. 308, Law No. 525, (79th Congress, 2d Session) as amended by Flood Control Acts of 1948 and 1950, authorized plans for comprehensive development of the Arkansas River and tributaries. The approved plan provides for development of the river for navigation, hydroelectric power, flood control, and allied benefits.

There are currently 25 federally constructed reservoirs on the tributaries and 5 on the main stem. Five reservoirs (Big Hill, Candy, Copan, El Dorado, and Skiatook) are under construction. In addition to the reservoirs, channel improvements and 17 locks and dams have been constructed to provide navigation from the mouth of the Arkansas River to Catoosa, Oklahoma. Construction began on the Arkansas River Navigation project in 1957. Navigation reached Little Rock in December 1968; Fort Smith in December 1969; and the Port of Catoosa, at the head of navigation, in December 1970. Pertinent data for these projects are shown on plates 2 and 3.

The Grand River Dam Authority has constructed three projects in the Lower Grand (Neosho) River Basin for hydroelectric power and flood control. These are Grand Lake (Pensacola), Salina pump-back storage project, and Lake Hudson. In addition to the above mentioned projects, the Soil Conservation Service has constructed numerous detention type structures to control runoff on the small tributary watersheds.

III. SYSTEM WATER CONTROL PLAN & REGULATION GOALS

A. General. The approved water control plan for the individual projects in the Arkansas River Basin are contained in the water control manual for each project. The water control plan for the system regulation of the projects in the Arkansas River Basin will be contained in the master water control manual for the basin. A brief description of the 1979 plan is presented in paragraph B. Any deviation or revision to these plans is subject to approval of the Southwestern Division, Reservoir Control Center. The goals to be accomplished by following the water control plans are presented in paragraph C below.

B. System Water Control Plan. The system water control plan provides for evacuation of water from flood storage at a variable rate which depends on the severity of the flood. The plan allows for a reduction in the release when only the lower portion of the flood pools are utilized. This reduced release rate allows more of the water to be used for the production of power and aids navigation by providing a "taper" to extend the time flows can be held in the 20,000 to 40,000 cfs range. This "taper" in the release at the end of large floods provides additional time for dredging that may be required to restore the channel to design dimensions. The plan also provides for some release from the power pools in order to extend the taper when necessary. The guide curve on plate 4 shows the regulated flow rate at Van Buren which varies according to the time of year and percent of basin storage utilized.

C. Goals for Various Purposes.

a. Fish and Wildlife Enhancement. The Fall River, Elk City, Council Grove, John Redmond, Wister, Blue Mountain, and Nimrod Lakes are regulated for fish and waterfowl enhancement in addition to the other authorized project purposes. This is accomplished through the use of seasonal pool levels. The plans for conservation pool level fluctuations are aimed at producing greater fish and wildlife harvests, and more fishing and hunting benefits.

b. Flood Control. The greatest portion of flood benefits in this basin are from damages prevented to crops and rural structures. About 60 percent of the benefits are obtained from rural areas and 40 percent from urban areas. The reservoirs are regulated according to the criteria prescribed by the plan of regulation for the system to make use of the available storage and downstream channel capacities.

c. Navigation. Arkansas River navigation from Tulsa to the mouth became a reality in December 1970. A navigable depth of nine feet will be maintained whenever practicable.

d. Power Production. The eight Federal hydropower plants in the Arkansas Basin are integrated into a system of plants located in the Arkansas-White-Red River Basins. The power is marketed by the Southwestern Power Administration (SWPA). Constraints on power generation are designed to minimize loss of energy, meet design capability, and meet the operation requirements for all project purposes.

e. Recreation. Recreation is not an authorized project purpose in most of the reservoirs; however, its importance is highly recognized. Recreation benefits, though difficult to evaluate, are obviously present. When practical, project operations may be restrained to stabilize pools or limit pool fluctuations. The seven Corps lakes which have recreation as an authorized project purpose are Kaw, Birch, Council Grove, Marion, John Redmond, Optima, and Robert S. Kerr. There are also two Bureau of Reclamation lakes, Cheney and Meredith, which have recreation as an authorized purpose.

f. Water Supply. Water supply storage in Federal reservoirs is allocated to a specific user. Reallocation of storage in an existing project from another purpose to water supply is possible under the Water Supply Act of 1958. Whenever a request for such a reallocation is received, the Corps of Engineers determines the amount of storage necessary to provide the required yield and the effect on all project purposes. The proposed reallocation is coordinated with other affected agencies.

g. Water Quality. Releases from projects containing water quality storage are made to meet current water quality flow requirements at downstream control points. Releases are also made for emergency conditions that may occur. Water quality improvement also occurs as a by-product of releases made to satisfy other project purposes.

D. Arkansas River Basin Compact; Arkansas-Oklahoma. The major purposes of this compact are:

a. To promote interstate comity between the States of Arkansas and Oklahoma.

b. To provide for an equitable apportionment of the waters of the Arkansas River between the States of Arkansas and Oklahoma and to promote the orderly development thereof.

c. To provide an agency for administering the water apportionment agreed to herein.

d. To encourage the maintenance of an active pollution abatement program in each of the two states and to seek the further reduction of both natural and manmade pollution in the waters of the Arkansas River Basin.

e. To facilitate the cooperation of the water administration agencies of the States of Arkansas and Oklahoma in the total development and management of the water resources of the Arkansas River Basin.

The major provisions of this compact provide for the apportionment of water between the two states based on a percentage of the annual yield.

E. Arkansas River Basin Compact, Kansas-Oklahoma. The major purposes of this compact are:

a. To promote interstate comity between the States of Kansas and Oklahoma.

b. To divide and apportion equitably between the States of Kansas and Oklahoma the waters of the Arkansas River Basin and to promote the orderly development thereof.

c. To provide an agency for administering the water apportionment agreed to herein.

d. To encourage the maintenance of an active pollution-abatement program in each of the two states and to seek the further reduction of both natural and manmade pollution in the waters of the Arkansas River Basin.

The major provisions of this compact provide for water apportionment based on conservation storage capacity.

V. SUMMARY OF 1978 REGULATIONS

A. General. The annual precipitation was below normal at every project in the basin. However, about one-half of the projects experienced normal or above normal precipitation for one or two months during the year. The annual precipitation at selected index stations ranged from 73 to 116 percent of normal. The following stations are shown as an index for the basin:

	Precipitation - Inches 1978	Normal	Departure From Normal
Dodge City, KS	20.76	20.58	+ 0.18
Wichita, KS	22.29	30.58	- 8.29
Chanute, KS	30.34	39.66	- 9.32
Tulsa, OK	38.19	36.90	+ 1.29
Fort Smith, AR	31.51	42.27	-10.76
Little Rock, AR	56.24	48.52	+ 7.72

The year began with the flows in the Arkansas River near normal and lake levels at conservation pool or slightly below. Moderate rainfall experienced in February produced sufficient runoff to cause several lakes to rise into the flood pool. In March there was sufficient rainfall and runoff to produce moderate rises in the pools of most lakes. Flood storage ranged from about 10 to 40 percent. The flows in the Arkansas River at Van Buren reached about 110,000 cfs on 25 March.

The water control plan for the Arkansas River Basin contains a feature which is referred to as a "navigation taper." This "navigation taper" is used at the end of large floods to extend the time flows in the river below Van Buren can be held in the 20,000 - 40,000 cfs range. This provides additional time for dredging that may be required to restore the navigation channel to design dimensions. The first "navigation taper" began 28 March and was rained out in early April and again in mid-April. The flood pools were returned to normal again toward the end of April. Subsequent small rains produced pool rises again on the 2d, 7th, and 21st of May which prolonged the navigation taper. Additional rain in June provided enough water to supply the "navigation taper" until mid-July. Rainfall occurrences were spaced far enough apart that flood spills were minimized from many of the hydropower projects. A large portion of the flood water was passed through the hydropower units.

The last significant runoff producing rainfall of the year occurred in late June. Much needed rainfall occurred again in mid-November

with amounts above normal for the month over much of the basin. However, the soil moisture was so low that very little runoff occurred. Portions of the Arkansas River Basin tributaries in Kansas received little of this rainfall, therefore, soil moisture and river flows were very low in much of Kansas at the year's end. At the end of the year, nearly every lake in the basin was below the conservation level with only minimum discharges for hydropower and water quality control being made.

The summer months of 1978 were the driest ever recorded and one of the hottest at Tulsa, Oklahoma, which is located in the mid portion of the Arkansas River Basin. Although the total rainfall for the entire year at Tulsa was slightly above normal, rainfall was only 1.86 inches for the period 22 June through 30 September. The temperature reached or exceeded 100 degrees on 38 days with a high for the year of 107 degrees. This does not approach the record year of 1936 when more than 60 days reached 100 degrees or more with an all time high of 115 degrees.

Impoundment began at Optima Lake on 2 October 1978 signaling completion of the first lake authorized by Congress in the area now compromising the Tulsa District. Construction of the Optima project had been delayed many times due to higher priorities.

The total runoff at Van Buren gage for 1978 was 16.6 million acre-feet as compared to a normal 23 million acre-feet for the 51-year period through 1978. A tabulation of the 1978 maximum and minimum pool elevations for the lakes in the basin is shown on plate 2. The recorded annual and monthly flows for the Arkansas River at Dam No. 13, near Van Buren, Arkansas, are shown on plates 5 and 6. A graph of the outflow from Dam No. 13 is shown on plate 7. Graphs of pool levels are shown on plates 8 through 15 for Kaw, Keystone, Fall River, Elk City, Oologah, Council Grove, John Redmond, Pensacola, Fort Gibson, Tenkiller Ferry, Eufaula, Wister, Blue Mountain, and Nimrod Lakes.

B. Fish and Waterfowl. The 1978 seasonal guide curves for Council Grove, Elk City, John Redmond, Toronto, Fall River, and Marion Reservoirs were modified from the 1977 curves at the request of the Kansas State Water Resources Board. The objective of the modification was to improve fishery and wildlife benefits. Minor deviations from the seasonal guide curves which were due to special operations are discussed in the special operations section of this report. Lack of inflow for the last six months of the year caused deviations from the seasonal guide curves at all six Kansas lakes. This particularly affected the fall rise, planned to enhance the waterfowl habitat and hunting.

Nimrod Lake was lowered 12 feet in cooperation with the Arkansas Game and Fish Commission (AG&FC), in an attempt to control the population of rough fish and thereby effect an improvement in the game fishery. The conservation pool was lowered from elevation 342 on 5 September to 332 on 1 October, to 330 on 1 December and was held at 330.0 from 1 December 1978 to 31 December 1978. Rye grass seed purchased by the Corps was applied to the exposed lake bed by AG&FC in early October. Rotenone applications on 14 and 15 October were used by AG&FC personnel for a partial fishkill. Refilling of the lake to the conservation pool began 31 December 1978. It was refilled by 2 January 1979.

C. Flood Control. During the fiscal year ending 30 September 1978, the 26 Corps of Engineers and Section 7, flood control reservoirs prevented $12,224,000 in flood damages in the Arkansas River Basin. The flood damages prevented during the past 15 years are shown on plate 16. The flood control activities for 1978 occurred during the period February through early July. The remainder of the year was dry.

a. Above Fort Smith.

Rainfall on 23 March produced enough runoff to cause rises into the flood pools at several lakes. The water control plan required that flood water be released at approximately 70,000 cfs. More rainfall during the period 2 through 11 April caused pool level rises which increased the equivalent, as in storage utilized, to 12 percent. The water control plan for 12 percent indicated a flow of 105,000 cfs at Van Buren should be maintained for approximately 3 days. Upon agreement between the Tulsa and Little Rock Districts and the Southwestern Division office, the target flow at Van Buren was modified to 80,000 cfs for evacuation of the remaining flood water in order to minimize the detrimental effect to the navigation channel. The 80,000 cfs rate was maintained from 11-18 April and the subsequent recession in flows and the navigation taper were nearly complete when more rain fell 28-29 April. Rainfall periods 5-8 May, 21-23 May, 3-8 June, and 18-22 June each prolonged the period the flows in the Arkansas River were between 20,000 and 75,000 cfs. By providing the navigation taper according to the Van Buren guide curve, the flows were between 20,000 cfs and 85,000 cfs during the period 23 March through 14 July. The following tabulation shows the date of peak pool, elevation, and percent full for the lakes affected by the March storm:

March 1978 Storm

Lake	Top Conservation Pool Elevation (m.s.l.)	Maximum Pool Elevation (m.s.l.)	Maximum Flood Storage Utilized (%)	Date 1978
Toronto	901.5	911.24	20	27 March
Fall River	948.5	955.85	10	27 March
Oologah	638.0	642.78	16	27 March
John Redmond	1039.0	1046.29	14	28 March
Pensacola	745.0	749.42	41	28 March
Hudson	619.0	626.38	37	28 March
Ft. Gibson	554.0	560.05	14	27 March
Tenkiller	632.0	639.85	20	27 March
Wister	471.6	482.87	19	27 March

The experienced and natural stages at key stations are shown in the following tabulation:

March 1978 Storm

Gage	Flood Stage (feet)	Experienced Stage (feet)	Natural Stage(1) (feet)	Flooding Prevented (feet)	Date
Fredonia	17.0	*	20.9	3.9	24 March
Independence	30.0	*	33.8	3.8	25 March
Oologah	39.0	*	40.9	1.9	26 March
Inola	42.0	*	43.1	1.1	25 March
Parsons	22.0	24.5	27.4	2.9	27 March
Commerce	15.0	18.7	20.8	2.1	28 March
Gore	13.0	*	16.5	3.5	25 March
Muskogee	26.0	*	26.4	0.4	25 March
Sallisaw	24.0	*	28.7	2.8	26 March
Poteau	20.0	23.8	30.7	6.9	25 March
Panama	24.0	29.5	34.6	5.1	26 March

*Below bankfull

(1) Natural stage would have occurred with no Corps of Engineers lakes.

b. Below Fort Smith. Two rises occurred in the Arkansas River Basin during the year, March and April. They are shown on plate 8. Rainfall during the period 21-24 March was 0.93 inch at Little Rock and 3.37 inches at Fort Smith. Rainfall from 4-6 April was 0.96 inch at Fort Smith and 0 inch at Little Rock. The rises on the Arkansas River were supplemented by rain in Oklahoma. The experienced natural stages at key stations are shown in the following tabulation.

STAGES AT KEY STATIONS

Gage	(NWS) Flood Stage	Experienced Stage (feet)	Natural Stage (1) (feet)	Approximate Reduction (feet)	Date
Van Buren	22	21.3	30.4	9.1	25 Mar
Van Buren	22	20.3	27.4	7.1	11 Apr
Ozark	357	354.0	362.6	8.6	25 Mar
Ozark	357	349.7	360.0	10.3	12 Apr
Dardanelle	32	24.4	34.0	9.6	25 Mar
Morrilton	30	23.8	32.6	8.8	25 Mar
Little Rock	23	12.3	21.4	9.1	26 Mar
Pine Bluff	47	36.9	40.0	3.1	27 Mar

(1) Natural stage which would have occurred without Corps of Engineers Reservoirs

(1) On the Fourche LaFave River Basin during May 1978, the Houston gage crested at 24.10 feet which was 0.10 foot above the critical flood stage of 24.0 feet. On 10 May 1978, 16 percent of Nimrod Lake's available flood control storage had been utilized. This reduced the stage at Houston about 6.4 feet.

(2) Flooding was also experienced in the Petit Jean River Basin during the same period. Danville crested at 22.8 feet on 8 May 1978 which is 2.8 feet above flood stage. On 11, 12, 13 May 1978, 12 percent of Blue Mountain Lake's flood control storage was utilized. This reduced the stage at Danville about 1.9 feet.

D. Navigation. Preliminary estimates indicate that about 10.2 million tons of commerce moved on the McClellan-Kerr Arkansas River Navigation System in 1978. This represents an increase of 12 percent above the 1977 level. Commodities consisted of bauxite, iron and steel, chemicals and chemical fertilizers, petroleum products, coal, sand and gravel, crushed stone, soybeans, wheat, other grains, and miscellaneous commodities. Outbound movements increased 80 percent. Commodities showing the greatest increase in movement from 1977 were coal, iron and steel, chemicals and chemical fertilizer and grains. The increase for these commodities were 140, 9, 24, and 7 percent, respectively. Tonnage graphs are shown on plates 17 and 18. A comparison of the tonnage for 1977 and 1978 is as follows:

	1977* (Tons)	1978** (Tons)
Inbound	2,692,108	2,600,000
Outbound	2,172,142	3,900,000
Internal	3,780,167	3,200,000
Through	501,539	500,000
TOTAL	9,145,956	10,200,000

*Waterborne Commerce Statistics Center
**Estimated

During 1978, the Arkansas River flows were generally excellent for navigation. The flows at Dam No. 2 were above 150,000 cfs for 1 day, between 75,000 cfs and 150,000 cfs for 50 days and below 75,000 cfs the remaining time. Low Mississippi River stages and low flows on the White River affected the lower 10 miles of the McClellan-Kerr System by decreasing navigation widths to less than the authorized width during periods in October and November. The White River Entrance Channel was restricted to tows 70 feet wide 18-23 October, 108 feet wide by 670 feet long 23 October to 8 November, and 70 feet wide by 670 feet long 8-21 November. A 9-foot channel was maintained and traffic continued to move without great difficulty.

Maintenance dredging to maintain navigable depths amounted to approximately 1.4 million cubic yards in 1978. This was a decrease of about 0.7 million cubic yards from the 1977 dredging requirements. Some of the pools were held above the normal elevation to maintain navigation while the channel was being dredged. Navigation-related accidents during the year were minor. A tower dolphin at Lock No. 2 was damaged by a commercial tow to the extent that it had to be removed. A mooring cell upstream of Lock No. 3 received significant damage when it was struck by a tow without power. The most involved accident occurred at

Lock and Dam No. 9 where a loaded coal barge sank in front of the spillway after damaging two tainter gates and a pier nose. Damage occurred at three locks when commercial barges collided with a miter gate.

E. Power Production. At the beginning of 1978 the storage projects were all within 1-1/2 feet of their rule curve elevations. The first half of the year inflows were near median or above with all the projects rising into the flood control pool. The summer and fall periods were the driest ever recorded, which resulted in low pools and reduced energy production. This condition continued until the end of the year leaving the storage projects below their rule curve elevations from 2-1/2 feet at Keystone to 6-1/2 feet at Tenkiller.

The Webbers Falls project which has three generators had a fire in October of 1977 which burned the No. 3 unit out. This unit was out of service for the entire year of 1978. It is expected to be placed back in service in February of 1979. The monthly hydropower generation for the eight Arkansas River Basin projects for 1978 was as follows:

Month	GWH	Month	GWH	Month	GWH	Month	GWH
Jan	111	Apr	327	Jul	169	Oct	19
Feb	170	May	386	Aug	85	Nov	41
Mar	335	Jun	358	Sep	60	Dec	44

The annual hydropower generation for five calendar years, 1974 through 1978, is shown in the following tabulation:

POWER GENERATION (gwh)
ARKANSAS RIVER BASIN PROJECTS

	ACTUAL FOR CALENDAR YEARS					5-Year Average	
	1974	1975	1976	1977	1978	1973-1977	1974-1978
Keystone	454	355	151	205	183	321	270
Fort Gibson	343	265	161	202	193	268	233
Webbers Falls	373	318	173	214	182*	-	252
Tenkiller	207	170	101	36	95	149	122
Eufaula	348	399	162	79	147	292	227
R.S. Kerr	849	704	411	469	474	643	581
Ozark	353*	469*	186*	308*	272*	-	318
Dardanelle	879	735	509	612	559	760	659
TOTAL	3806	3415	1854	2125	2105	-	2662

*Forced outages (30 days or more) of 1 or more units due to mechanical problems.

F. Recreation. The lakes and navigation pools in the Arkansas River Basin provide vast expanses of water shoreline for use in meeting the growing demands for water-associated recreation. The natural beauty of the area is considered in planning public use areas at these lakes. Recreational development plans are coordinated with state and Federal park, fish and wildlife, and archaeological agencies.

The experimental seasonal pool at Wister Lake, in effect since June 1974, was approved in August 1978 for a permanent seasonal operation. However, due to the lack of sufficient rainfall, the pool never reached the desired level, elevation 478.0, in 1978. Elevation 475.4 was the highest elevation reached during the summer recreational season. A graph of the Wister pool level is shown on plate 14.

In the Little Rock District there are 76 parks planned for development in the McClellan-Kerr Navigation System. Fifty-seven of these parks have been developed under the initial recreation program at a cost of approximately $26 million. While most of these parks are now available for public use, all will be completed in Fiscal Year 1981. These parks are being managed by the Corps of Engineers. Nine others have been jointly developed by the Corps and non-Federal interests and two were developed by non-Federal interests. Ten more parks are reserved for future development, two of which are to be developed by the State of Arkansas.

During 1977 the commercial fish catch in the Arkansas River (Arkansas and Oklahoma) was 2.85 million pounds with a value of $0.98 million. In Oklahoma the mussel harvest had a value of $471,000. In 1977 there were 57 licensed commercial fishermen in Oklahoma and 2,347 in Arkansas (the states do not break these down by rivers).

The overall lake attendance for 1978 was approximately 1 percent less than for 1977. Attendance records were begun in 1977 for two new lakes Birch and Optima. Lake attendance for the period 1974 through 1978 is summarized in the following tabulation. The lake attendance includes visitation to the lake and associated parks for various recreational and sports activities.

ARKANSAS RIVER BASIN
LAKE ATTENDANCE
(1000's of People)

Lake	Calendar Year 1974	1975	1976	1977	1978
Cheney	1,007	575	601	585	(2)
Great Salt Plains	795	1,136	914	793	930
Keystone	3,646	3,022	4,129	3,873	4,179
Heyburn	593	783	1,124	792	501
Toronto	509	608	634	578	420

ARKANSAS RIVER BASIN
LAKE ATTENDANCE (CONTI-)
(1000's of People)

Lake	1974	1975	1976	1977	1978
Fall River	371	434	520	493	433
Elk City	488	552	686	489	508
Oologah	1,232	1,421	1,781	1,841	1,801
Hulah	588	684	1,125	989	678
Birch	-	-	-	79	111
Council Grove	1,019	879	1,060	917	719
Marion	1,163	794	928	806	693
John Redmond	444	608	528	623	455
Grand Lake (Pensacola)(1)	137	509	1,257	1,259	1,209
Lake Hudson (Markham Ferry)(1)	30	35	41	44	64
Fort Gibson	3,998	4,110	3,570	6,944	7,228
Tenkiller Ferry	4,962	5,226	5,668	6,514	4,064
Lake Meredith (Sanford)	1,732	1,709	1,826	1,631	1,782
Lake Thunderbird (Norman)(1)	1,751	1,356	1,730	1,998	(2)
Optima	-	-	-	6	33
Fort Supply	431	550	948	721	674
Canton	1,368	2,473	2,728	2,843	3,018
Eufaula	4,575	4,694	5,387	6,319	7,242
Wister	983	1,086	1,075	1,024	1,087
Blue Mountain	262	244	223	232	184
Nimrod	494	493	495	440	444
Newt Graham Lock & Dam	115	301	500	726	646
Chouteau	225	294	360	488	534
Webbers Falls	249	542	583	1,142	1,243
Robert S. Kerr	673	848	1,055	1,195	1,834
W. D. Mayo	89	144	282	228	296
Lock and Dam No. 13	199	583	599	675	757
Ozark (Jeta Taylor) Lock and Dam	581	611	860	953	1,022
Dardanelle Lock and Dam	2,326	2,202	2,778	3,259	3,441
Lock and Dam No. 9	137	159	354	345	403
Toad Suck Ferry Lock and Dam	134	248	530	541	680

ARKANSAS RIVER BASIN
LAKE ATTENDANCE (CONTI-)
(1000's of People)

Lake	Calendar Year 1974	1975	1976	1977	1978
Murray	402	541	811	819	1,005
David D. Terry	398	635	824	1,570	1,195
Lock and Dam No. 5	259	288	255	176	314
Lock and Dam No. 4	594	531	615	197	182
Lock and Dam No. 3	186	226	231	231	206
Lock and Dam No. 2	568	513	639	488	446
Norrell Lock and Dam	75	68	68	36	49

(1) Attendance shown was furnished by Oklahoma Tourism and Recreation Department. This is for State parks only.
(2) Not available @ publication time.

G. Water Supply. Water supply storage space is allocated in 17 of the existing Corps of Engineers lakes in the basin. Contracts for all or portions of this space are in effect at all of these lakes except Optima, Kaw, and Birch. During 1978 a total of 54,527 acre-feet of water was supplied from the storage space in these lakes. This amount is about 5 percent less than the amount used in 1977. The following tabulation shows the lakes which have water supply storage.

WATER SUPPLY

Reservoir	Water Supply: Allocation (ac-ft)	Contracts (ac-ft)	Number of Contracts	Water Supplied (ac-ft): 1977	1978
Kaw	171,200	None	None	None	None
Keystone	20,000	18,450	4	171	169
Heyburn	2,000	900	2	669	759
Toronto	400	265	1	80	85
Elk City	24,300	24,300	1	None	None
Oologah	342,600	44,200	6	7,859	10,742
Hulah	19,800	17,700	2	6,739	3,639
Birch	7,600	None	None	None	None
Council Grove	24,400	24,400	1	None	None
Marion	38,300	38,300	1	None	None
John Redmond	34,900	34,900	1	None	None

WATER SUPPLY
(CONTI-)

Reservoir	Water Supply			Water Supplied (ac-ft)	
	Allocation (ac-ft)	Contracts (ac-ft)	Number of Contracts	1977	1978
Fort Gibson	None	None	None	10,971(1)	12,997(1)
Tenkiller Ferry	25,400	18,566	28	3,584	4,316
Optima	76,200	None	None		
Fort Supply	400	400	1	208	250
Canton	107,000(2)	90,000(3)	2	36,133	30,445
Eufaula	56,000	2,320	18	1,247	1,252
Wister	9,600	6,400	2	424	2,865

NOTE: (1) Water supplied to satisfy pre-project water rights.
(2) Water supply - 38,000 acre-feet; Irrigation - 69,000 acre-feet.
(3) Water supply - 38,000 acre-feet; Irrigation - 52,000 acre-feet (currently being used for W.S. purposes pending development of irrigation features).

H. Water Quality. A Corps of Engineers dredge material sampling program along the Arkansas River is continuing to determine if dredging areas are polluted according to Environmental Protection Agency criteria. Thus far, all area samples have fallen within safe limits established by EPA and no dredging operations would be prohibited by these criteria.

a. Above Fort Smith.

(1) The Tulsa District is currently collecting water quality data at regular intervals from Eufaula, Oologah, Tenkiller, Toronto, and Wister Lakes. In addition to the above mentioned lakes, water quality data was collected by contract at various locations in the McClellan-Kerr Arkansas River Navigation System, and at Kaw, Keystone, John Redmond, and Oologah Lakes during the 1978 calendar year.

(2) Preparation of the Phase I General Design Memorandum for Salt Control measures for the Arkansas River Basin is continuing. Water quality samples are being taken in and near the source areas.

(3) Releases from Tenkiller Lake were continued on the same regular schedule as in past years for the purpose of trout fishing below

the dam. Also, special releases were made at Great Salt Plains to prevent fish kills.

b. Below Fort Smith.

(1) The principle water quality problems continue to be turbidity, excessive chlorides, and bacteria. While the total salt load has not diminished greatly, the extremes of concentrations have been leveled out due to the flow regulation features of the project.

(2) The city of Fort Smith completed sewage treatment upgrading in December 1978 and now meets secondary treatment effluent limitations which include chlorination and this should greatly improve chemical and bacteriological water quality in that portion of the river. The city of North Little Rock is presently upgrading its Faulkner Lake treatment plant and is constructing a new White Oak Bayou Plant to replace a primary treatment plant on Shillcutt Bayou near Burns Park. The projects should be completed in November 1979 and should cause a marked improvement in river water quality in the Little Rock area.

(3) During periods of low or zero natural flow in the Petit Jean River, a release of not less than 5 cubic feet per second is made from Blue Mountain Lake. This release supplies water to the natural pools in the river and aids in maintaining fish life.

(4) Water quality monitoring along the Arkansas River and many of its tributaries are done by the US Geological Survey (USGS) and the Arkansas Department of Pollution Control and Ecology on a regular basis. Water quality data concerning various reaches of the river are available from those agencies.

I. Sedimentation. Maintenance dredging in the McClellan-Kerr Arkansas River Navigation System during 1978 was about 0.7 million cubic yards less than the dredging required in 1977. The following tabulation shows the maintenance dredging by year since 1972.

Calendar Year	Maintenance Dredging (Million Cu Yards)			Annual Flow @ Van Buren, AR (Million Ac-Ft)
	Tulsa Dist	Little Rock Dist	Total	
1972	1.7	2.4	4.1	14.1
1973	1.1	3.5	4.6	61.1
1974	3.7	3.6	7.3	44.4
1975	0.7	1.4	2.1	33.9
1976	0.5	1.9	2.4	14.3
1977	0.4	1.7	2.1	15.1
1978	0.2	1.2	1.4	16.6

Sediment surveys of Heyburn and Great Salt Plains Lakes were conducted during the year. Interruptions in the land portion of the Great Salt Plains survey due to the migration of ducks, geese, and whooping cranes have delayed completion until 1979.

A detailed report on the 1969 sedimentation survey of Fort Supply Lake and an abbreviated report on the first resurvey of sedimentation of Lock and Dam No. 13 were completed and approved.

The suspended sediment sampling program was revised to give better coverage of present areas of interest. A total of 42 stations were added, 33 stations dropped, and 27 stations retained. There are 70 stations presently in operation.

J. Special Operations. Several short-term special operations were required during the year. These are summarized as follows:

a. Special drawdowns were made at Kaw to inspect and repair the riprap on the face of the dam; at Marion to aid construction of a new boat ramp; and at John Redmond to facilitate additional riprap repair.

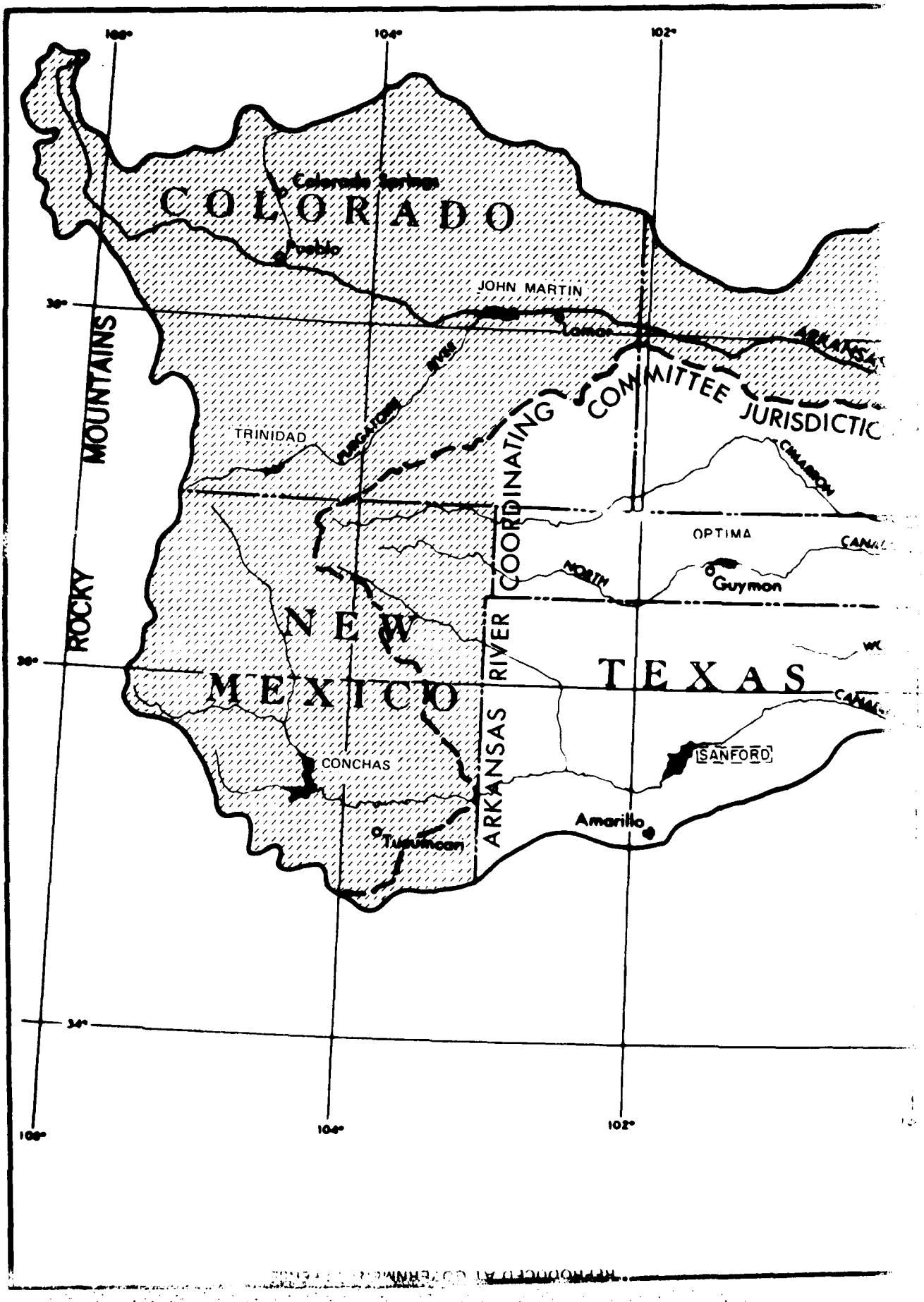
b. Discharges were reduced at Keystone on 29 June and 3 July to assist in search and recovery of drowning victims; at Elk City in August to facilitate repair work on a bank slumped area in the outlet channel; at Oologah in April to help in recovery of a sunken airboat, 1 July to aid in the search for a drowning victim, in August and September for inspection of conduits; at Hulah to aid in removal of a buoy line in the gates.

c. Special releases were made at Great Salt Plains from mid-July through September to eliminate fish kills and for pollution abatement.

d. As stated before, the seasonal guide curve at Wister Lake was continued in 1978 and is now a permanent seasonal operation.

Plans for 1979

No changes to the System Regulation Plan used in 1978 are planned for 1979.


COLORADO
NEW MEXICO
TEXAS
ROCKY MOUNTAINS
ARKANSAS RIVER
COORDINATING COMMITTEE JURISDICTIC
JOHN MARTIN
TRINIDAD
CONCHAS
OPTIMA
Guymon
SANFORD
Amarillo
Tucumcari
Lamar
Pueblo
Colorado Springs
104°
102°
38°
36°


CONCIL GROVE
MARION
JOHN REDMOND
CEDAR POINT
EL DORADO
TOWANDA
CHENEY
TORONTO
KANSAS
DOUGLAS
FALL RIVER
NEODESHA
ELK CITY
HULAH
GREAT SALT PLAINS
COPAN
Carthage
SAND
KAW
SHIDLER
PENSACOLA
Woodward
Enid
BIRCH
CANDY
OOLOGAH
SKIATOOK
CANTON
KEYSTONE
HUDSON
Tulsa
FORT GIBSON
HEYBURN
Jenks
TENKILLER
NEWT GRAHAM L&D
CHOUTEAU L&D
WEBBERS FALLS
ROBERT S. KERR
OZARK
Oklahoma City
NORMAN
EUFAULA
W. D. MAYO L&D
Fort Smith
LBD 13
BLUE MT
WISTER
OKLAHOMA


LEGEND:
RESERVOIR IN OPERATION
RESERVOIR UNDER CONSTRUCTION
RESERVOIR NOT STARTED
LOCKS AND DAMS APPROVED
LEVEE AUTHORIZED OR COMPLETED
CHANNEL IMPROVEMENT
F FLOOD CONTROL
P POWER
N NAVIGATION
W WATER SUPPLY
I IRRIGATION
C CONSERVATION (Low flow regulation)
GRAND RIVER DAM AUTHORITY
BUREAU OF RECLAMATION PROJECT
F & W FISH AND WILDLIFE
R RECREATION
Q WATER QUALITY
N
94°
93°
36°
35°
MISSOURI
ARKANSAS
Carthage
PENSACOLA
GIBSON
TENKILLER
ROBERT S. KERR
OZARK
DARDANELLE
L&D 9
TOAD SUCK FERRY L&D 8
Conway
Fort Smith
AYO L&D
L&D 13
BLUE MT
MURRAY L&D 7
NIMROD
DAVID D. TERRY
L&D 6
WISTER
Little Rock
L&D 5
LOCK 2
Pine Bluff
L&D 4
L&D 3
DAM 2
NORRELL L&D 1
MISSISSIPPI RIVER
Memphis
ARKANSAS RIVER WATERSHED
ARKANSAS RIVER, ARKANSAS
WATERSHED MAP
SCALE OF MILES
50
0
50
LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
LITTLE ROCK, ARKANSAS, SEPTEMBER 1974
DRAWN: ALC
TRACED: HJH
CHECKED: DLW
REVISED MAY 1975 CM

PLATE 1

ANNUAL MAXIMUM AND MINIMUM POOL ELEVATIONS
ARKANSAS RIVER BASIN PROJECTS BELOW GREAT BEND KANSAS

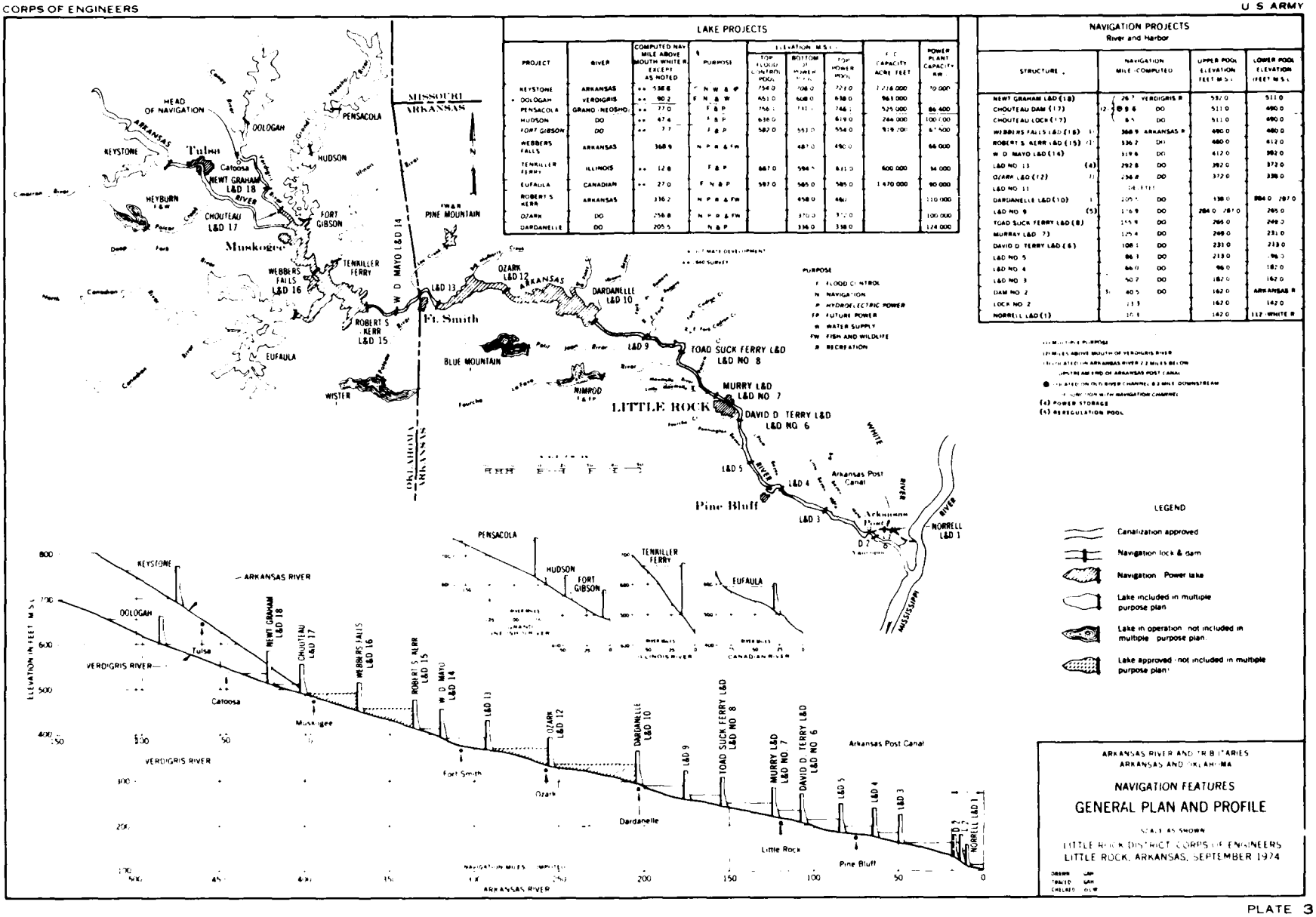
PROJECT	STREAM	YEAR IN OPERATION	CONSERVATION		FLOOD CONTROL		1978 POOL ELEVATIONS			
				STORAGE		STORAGE	MAXIMUM		MINIMUM	
			POOL ELEV	AC-FT	POOL ELEV	AC-FT	ELEV	DATE	ELEV	DATE
Cheney 1/	N. F. Ninnescah	1964	1421.6	151,800	1429.0	80,860	1422.92	30 May	1419.28	11 Nov
Great Salt Plains	Salt Fork Ark	1941	1125.0	0	1138.5	242,700	1127.97	3 Jun	1123.34	6 Nov
Kaw	Arkansas R.	1976	1010.0	343,500	1044.5	919,400	1016.08	23 May	1004.81	16 Nov
Keystone	Arkansas R.	1964	723.0	351,000	754.0	1,216,000	729.14	31 May	711.02	19 Sep
Heyburn	Polecat Cr.	1950	761.5	4,400	784.0	49,100	767.84	7 May	759.49	13 Nov
Toronto	Verdigris R.	1960	901.5	10,700	931.0	172,000	911.24	27 Mar	898.24	28 Dec
Fall River	Fall R.	1949	948.5	15,700	987.5	235,100	955.85	27 Mar	945.05	31 Dec
Elk City	Elk R.	1966	792.0	33,500	825.0	256,400	802.63	22 May	789.83	14 Nov
Oologah	Verdigris R.	1963	638.0	544,100	661.0	965,600	643.13	11 Apr	634.23	12 Nov
Hulah	Caney R.	1950	733.0	33,400	765.0	257,800	747.47	23 May	728.37	30 Dec
Birch	Birch Cr.	1977	750.5	15,840	774.0	39,000	750.46	22 May	746.43	31 Dec
Council Grove	Neosho R.	1964	1270.0	37,800	1289.0	76,000	1274.48	13 Jun	1268.56	10 Nov
Marion	Cottonwood R.	1968	1350.5	85,860	1358.5	59,900	1351.60	4 Jun	1346.82	14 Nov
John Redmond	Neosho R.	1964	1036.0	54,000	1068.0	588,100	1046.29	28 Mar	1033.36	31 Oct
Pensacola 1/	Neosho R.	1940	745.0	586,000	755.0	525,000	749.42	28 Mar	733.81	14 Nov
Lake Hudson 1/	Neosho R.	1964	619.0	0	636.0	244,000	627.05	13 Apr	618.08	30 May
Fort Gibson	Neosho R.	1952	554.0	53,900	582.0	919,200	560.49	23 Jun	552.53	5 Dec
Webbers Falls	Arkansas R.	1970	490.0	30,000	-	0	490.54	7 Jul	487.36	3 Feb
Tenkiller Ferry	Illinois R.	1951	634.0	358,900	667.0	589,400	639.85	27 Mar	623.53	29 Dec
Conchas	Canadian R.	1939	4201.0	273,000	4218.0	198,300	4168.53	3 Jul	4158.25	2 Nov
Sanford 1/	Canadian R.	1965	2941.3	866,300	2965.0	462,100	2899.04	14 Jun	2894.39	30 Apr
Norman 1/	Little R. (Ark)	1965	1039.0	105,900	1049.4	76,600	1046.52	23 Jun	1033.08	29 Dec
Optima 2/	N. Canadian R.	1978	2763.5	117,650	2779.0	100,500	2716.60	8 Jun	2707.85	3 Nov
Fort Supply	Wolf Cr.	1941	2004.0	400	2028.0	87,200	2004.90	31 May	2002.87	31 Oct
Canton	N. Canadian R.	1948	1615.2	97,700	1638.0	267,600	1616.05	14 Jun	1608.01	1 Jan
Eufaula	Canadian R.	1964	585.0	1,451,000	597.0	1,470,000	587.66	9 Jun	579.43	27 Dec
Robert S. Kerr	Arkansas R.	1970	460.0	79,500	-	0	460.55	23 Jun	458.38	12 Dec
Wister	Poteau R.	1949	471.6	30,000	502.5	400,000	482.87	27 Mar	471.06	15 May
Ozark	Arkansas R.	1969	372.0	19,400	-	0	372.7	14 Feb	370.1	18 Mar
Dardanelle	Arkansas R.	1964	338.0	65,000	-	0	338.4	7 May	336.4	22 May
Blue Mountain	Petit Jean	1947	384.0	0	419.0	233,000	394.3	12 May	376.5	1 Jan
Nimrod	Fourche La Fave R.	1942	342.0	0	373.0	307,000	352.9	10 May	329.95	16 Dec

1/ Non-Corps project under Sec 7 of 1944 F/C Act
2/ Non significant rise in pool since closure on 2 Oct 78

PLATE 2

CORPS OF ENGINEERS

U S ARMY



LAKE PROJECTS

PROJECT	RIVER	COMPUTED NAV MILE ABOVE MOUTH WHITE R EXCEPT AS NOTED	PURPOSE	ELEVATION M.S.L. TOP FLOOD CONTROL POOL	ELEVATION M.S.L. BOTTOM OF POWER POOL	ELEVATION M.S.L. TOP POWER POOL	F.C. CAPACITY ACRE FEET	POWER PLANT CAPACITY KW
KEYSTONE	ARKANSAS	** 538.6	F N W & P	754.0	708.0	721.0	1,216,000	70,000
OOLOGAH	VERDIGRIS	** 90.2	F N & W	651.0	608.0	638.0	961,000	
PENSACOLA	GRAND (NEOSHO)	** 77.0	F & P	796.0	741.0	796.0	525,000	86,400
HUDSON	DO	** 47.6	F & P	636.0		619.0	266,000	100,000
FORT GIBSON	DO	** 7.7	F & P	582.0	551.0	554.0	919,700	67,500
WEBBERS FALLS	ARKANSAS	368.9	N P R & Fw		487.0	490.0		66,000
TENNILLER FERRY	ILLINOIS	** 12.8	F & P	667.0	594.5	611.0	600,000	34,000
EUFAULA	CANADIAN	** 27.0	F N & P	597.0	565.0	585.0	1,470,000	90,000
ROBERT S KERR	ARKANSAS	336.2	N P R & Fw		458.0	461.		110,000
OZARK	DO	256.8	N P R & Fw		370.0	372.0		100,000
DARDANELLE	DO	205.5	N & P		336.0	338.0		124,000

** 540 SURVEY

PURPOSE
F FLOOD CONTROL
N NAVIGATION
P HYDROELECTRIC POWER
FP FUTURE POWER
W WATER SUPPLY
FW FISH AND WILDLIFE
R RECREATION

NAVIGATION PROJECTS
River and Harbor

STRUCTURE		NAVIGATION MILE COMPUTED		UPPER POOL ELEVATION FEET M.S.L.	LOWER POOL ELEVATION FEET M.S.L.
NEWT GRAHAM L&D (18)		26.7	VERDIGRIS R	592.0	511.0
CHOUTEAU DAM (17)	(2)	8.6	DO	511.0	490.0
CHOUTEAU LOCK (17)		8.5	DO	511.0	490.0
WEBBERS FALLS L&D (16)	(1)	368.9	ARKANSAS R	490.0	480.0
ROBERT S. KERR L&D (15)	(1)	336.2	DO	480.0	412.0
W. D. MAYO L&D (14)		319.6	DO	412.0	392.0
L&D NO. 13	(4)	292.8	DO	392.0	372.0
OZARK L&D (12)	(1)	256.8	DO	372.0	338.0
L&D NO. 11		[illegible]			
DARDANELLE L&D (10)	(1)	205.5	DO	338.0	304.0 287.0
L&D NO. 9	(5)	176.9	DO	304.0 287.0	265.0
TOAD SUCK FERRY L&D (8)		155.8	DO	265.0	249.0
MURRAY L&D 7)		125.4	DO	249.0	231.0
DAVID D. TERRY L&D (6)		108.1	DO	231.0	213.0
L&D NO. 5		86.3	DO	213.0	196.0
L&D NO. 4		66.0	DO	196.0	182.0
L&D NO. 3		50.7	DO	182.0	162.0
DAM NO. 2	(3)	40.5	DO	162.0	ARKANSAS R
LOCK NO. 2		23.3		162.0	142.0
NORRELL L&D (1)		10.1		142.0	112 WHITE R

[illegible] PURPOSES
[illegible] MILES ABOVE MOUTH OF VERDIGRIS RIVER
[illegible] LOCATED IN ARKANSAS RIVER 7.2 MILES BELOW
[illegible] UPSTREAM END OF ARKANSAS POST CANAL
[illegible] LOCATED ON OLD RIVER CHANNEL 8.2 MILES DOWNSTREAM
[illegible] JUNCTION W/ MISSISSIPPI RIVER NAVIGATION CHANNEL
(a) POWER STORAGE
(b) REREGULATION POOL

LEGEND
- Canalization approved
- Navigation lock & dam
- Navigation Power lake
- Lake included in multiple purpose plan
- Lake in operation not included in multiple purpose plan
- Lake approved not included in multiple purpose plan

ARKANSAS RIVER AND TRIBUTARIES
ARKANSAS AND OKLAHOMA

NAVIGATION FEATURES
GENERAL PLAN AND PROFILE

SCALE AS SHOWN

LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
LITTLE ROCK, ARKANSAS, SEPTEMBER 1974

DRAWN JAH
TRACED JAH
CHECKED [illegible]

PLATE 3

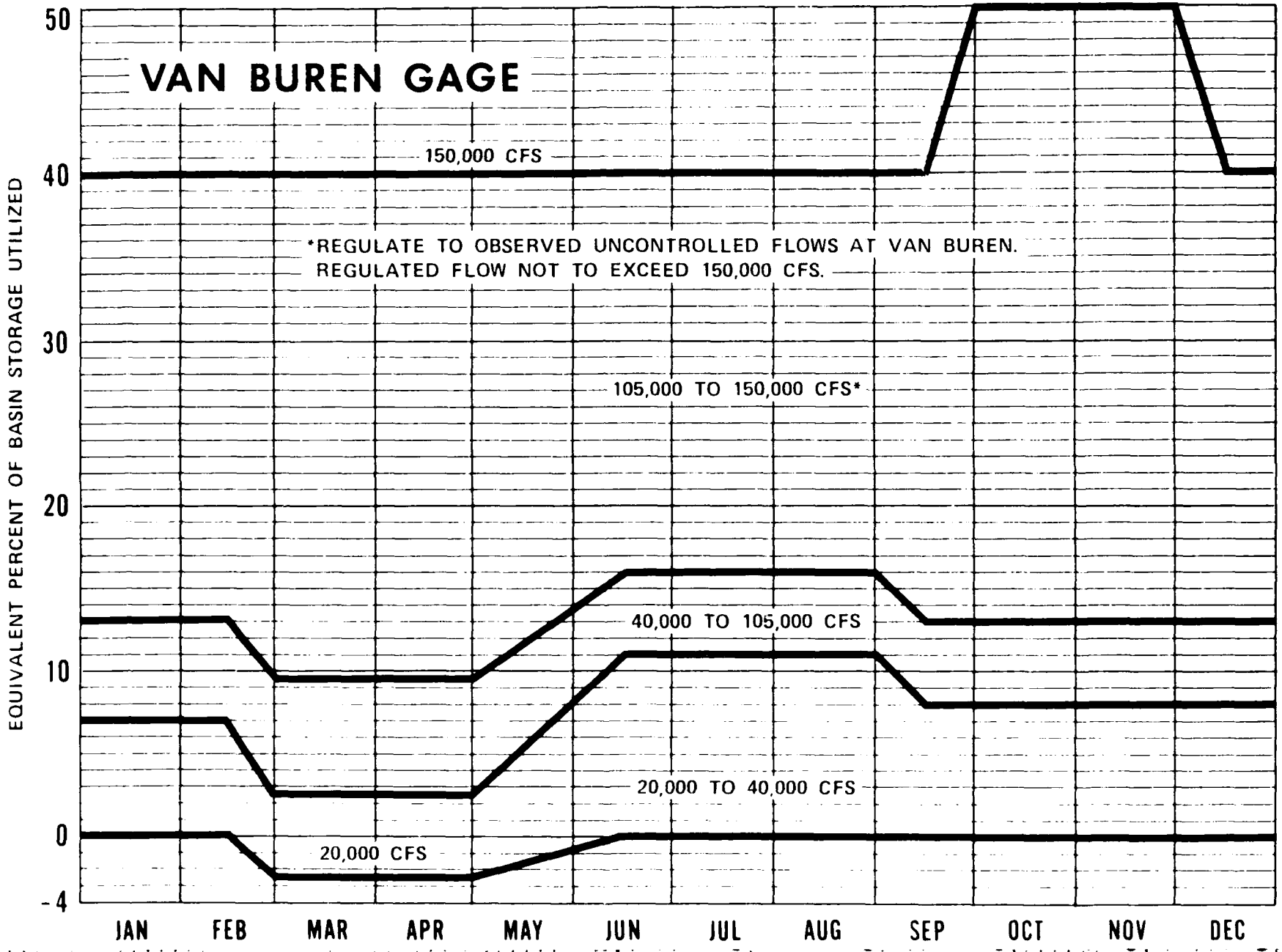

VAN BUREN GAGE
EQUIVALENT PERCENT OF BASIN STORAGE UTILIZED
50
40
30
20
10
0
-4
150,000 CFS
*REGULATE TO OBSERVED UNCONTROLLED FLOWS AT VAN BUREN.
REGULATED FLOW NOT TO EXCEED 150,000 CFS.
105,000 TO 150,000 CFS*
40,000 TO 105,000 CFS
20,000 TO 40,000 CFS
20,000 CFS
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

PLATE 4

ANNUAL RECORDED FLOW

ARKANSAS RIVER AT DAM No. 13, NEAR VAN BUREN, ARKANSAS

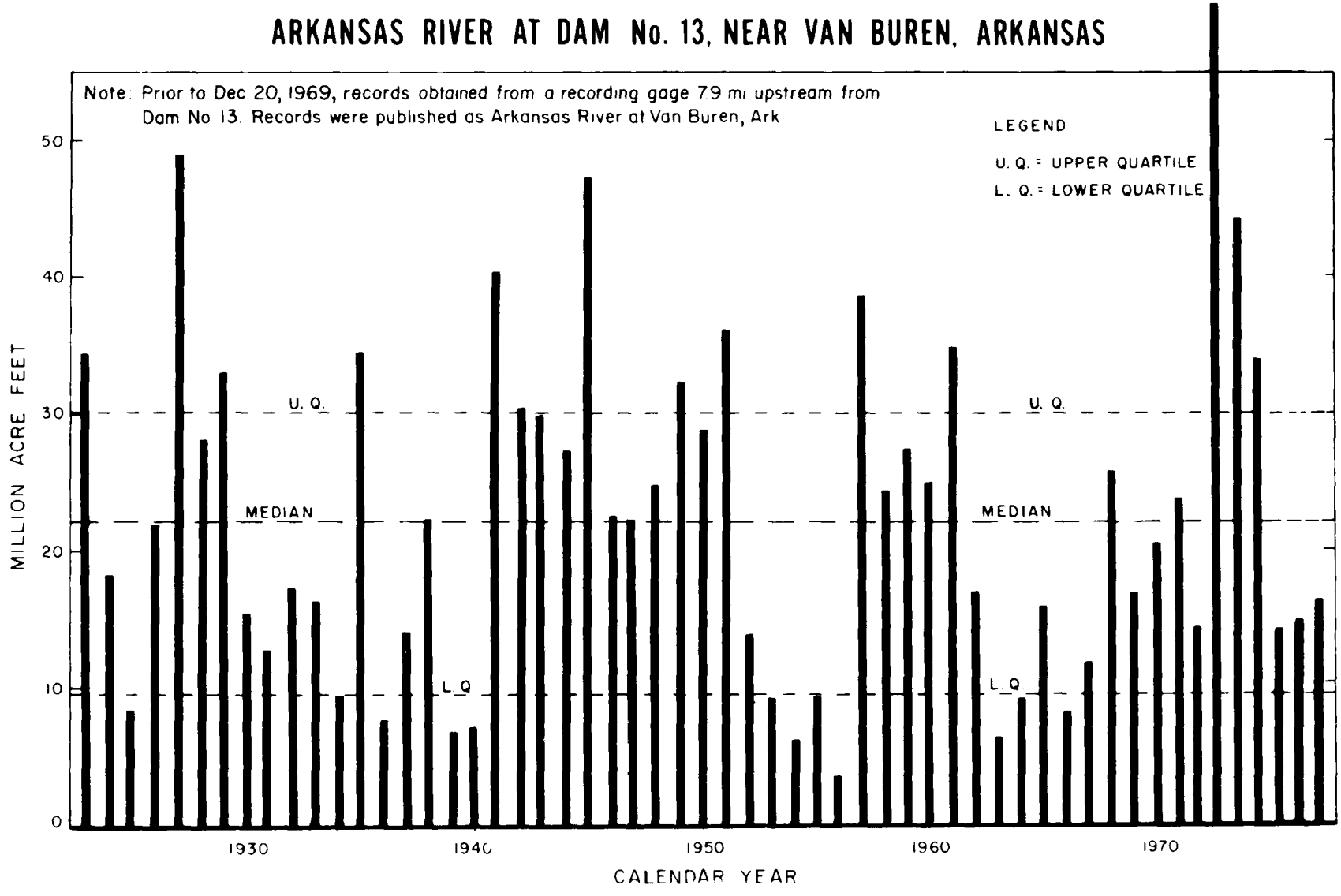
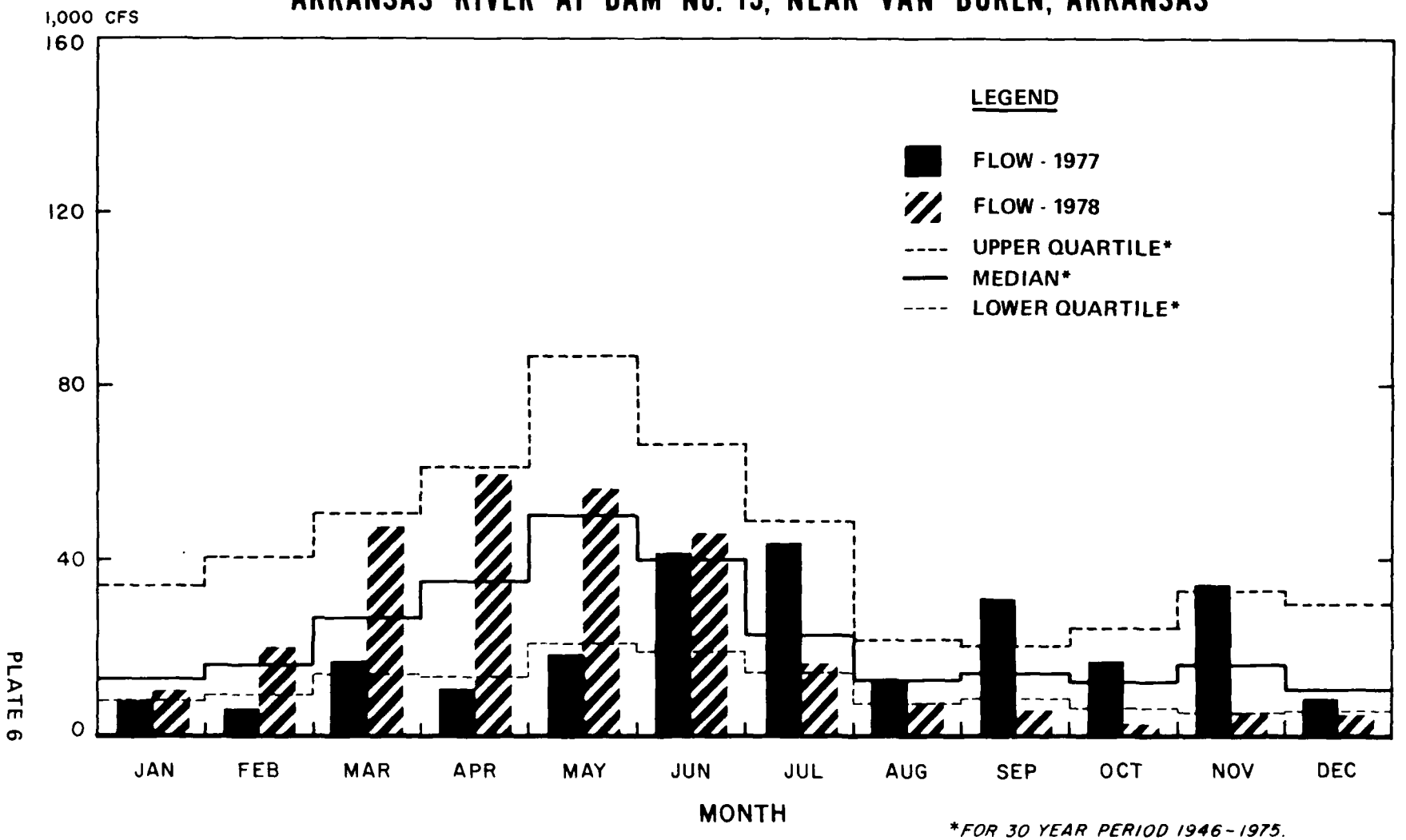


PLATE 5

AVERAGE MONTHLY RECORDED FLOWS

ARKANSAS RIVER AT DAM No. 13, NEAR VAN BUREN, ARKANSAS



*FOR 30 YEAR PERIOD 1946-1975.

PLATE 6

LOCK & DAM No. 13 - OUTFLOW HYDROGRAPH
1978

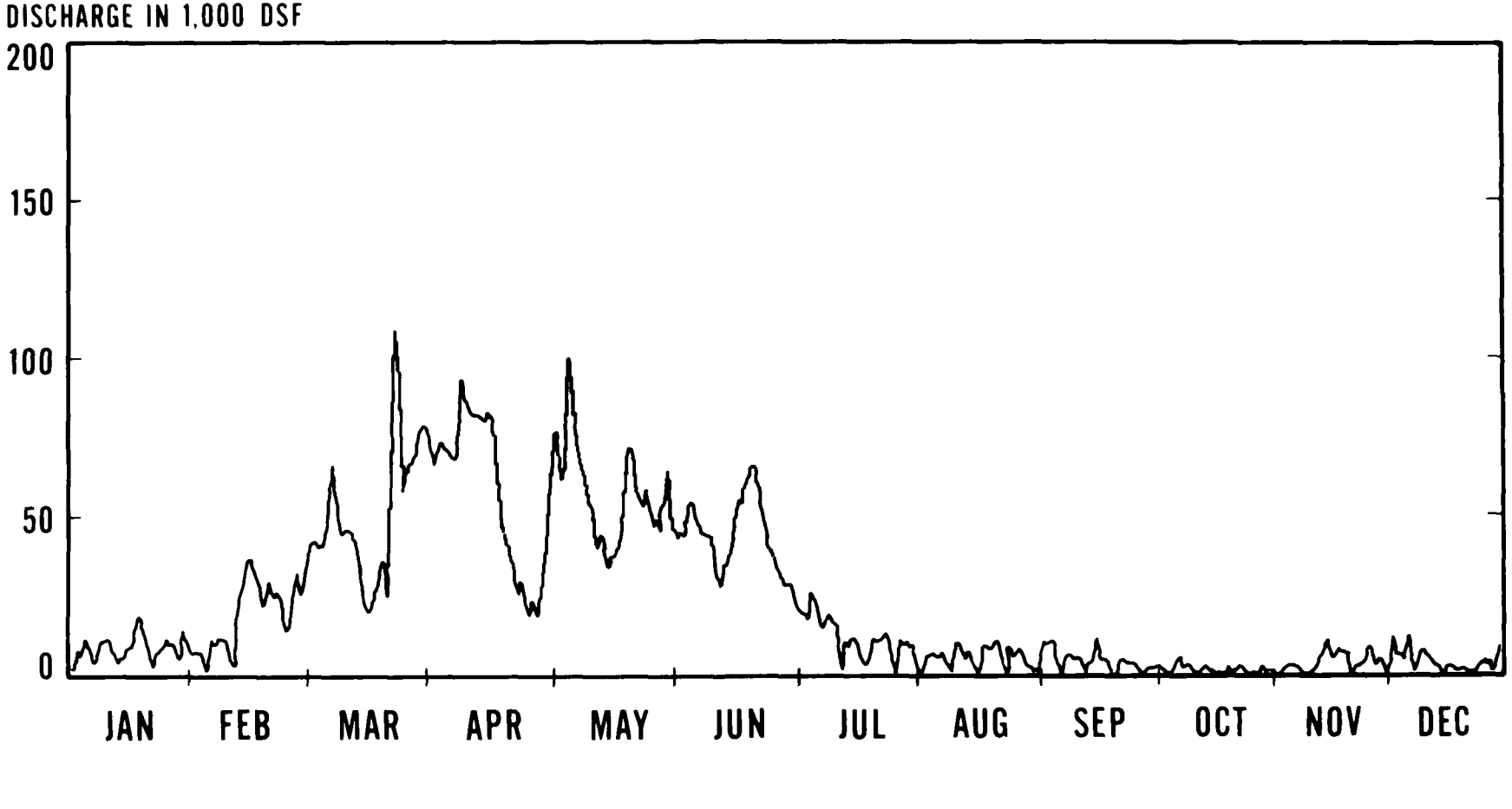


PLATE 7

KAW RESERVOIR

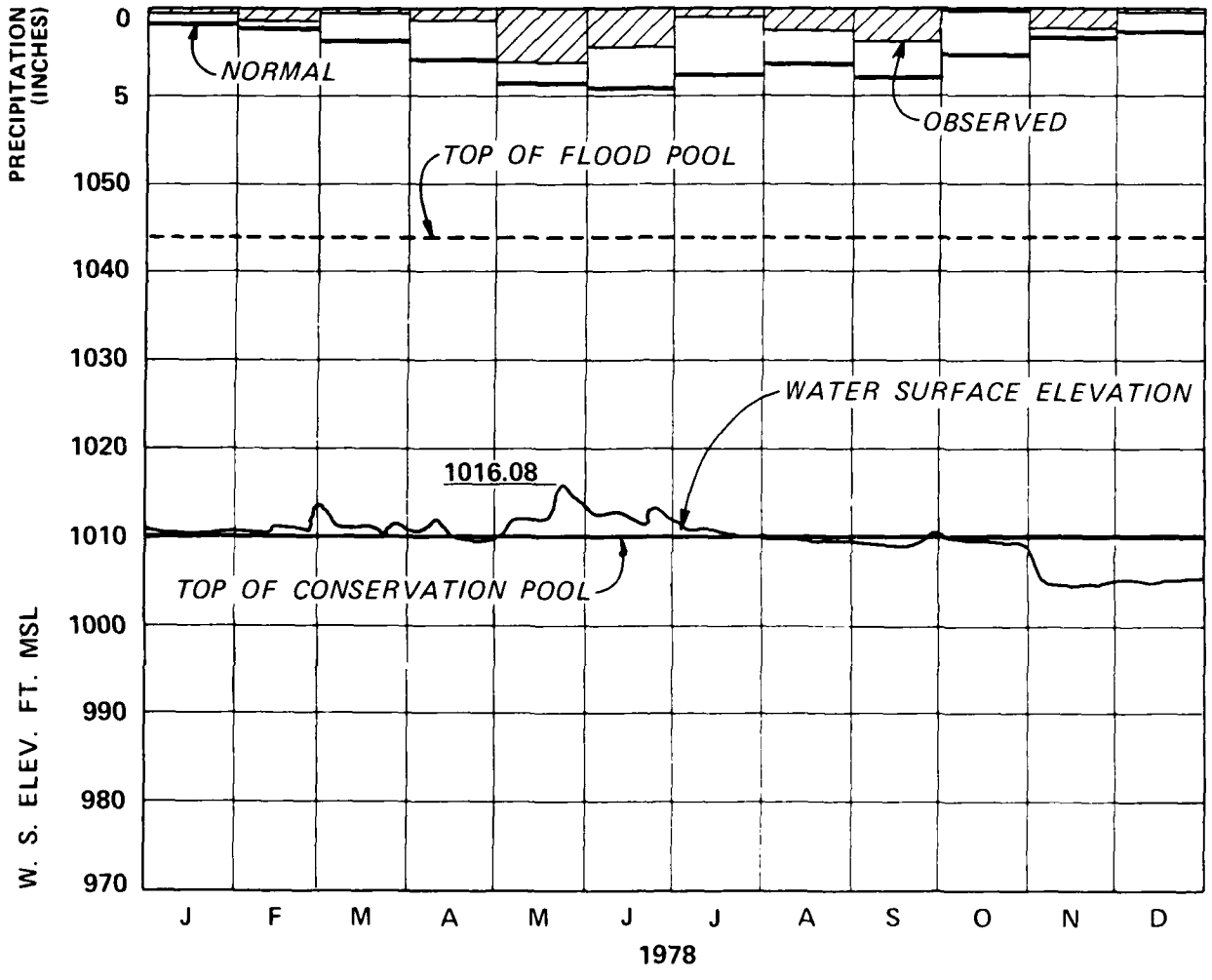
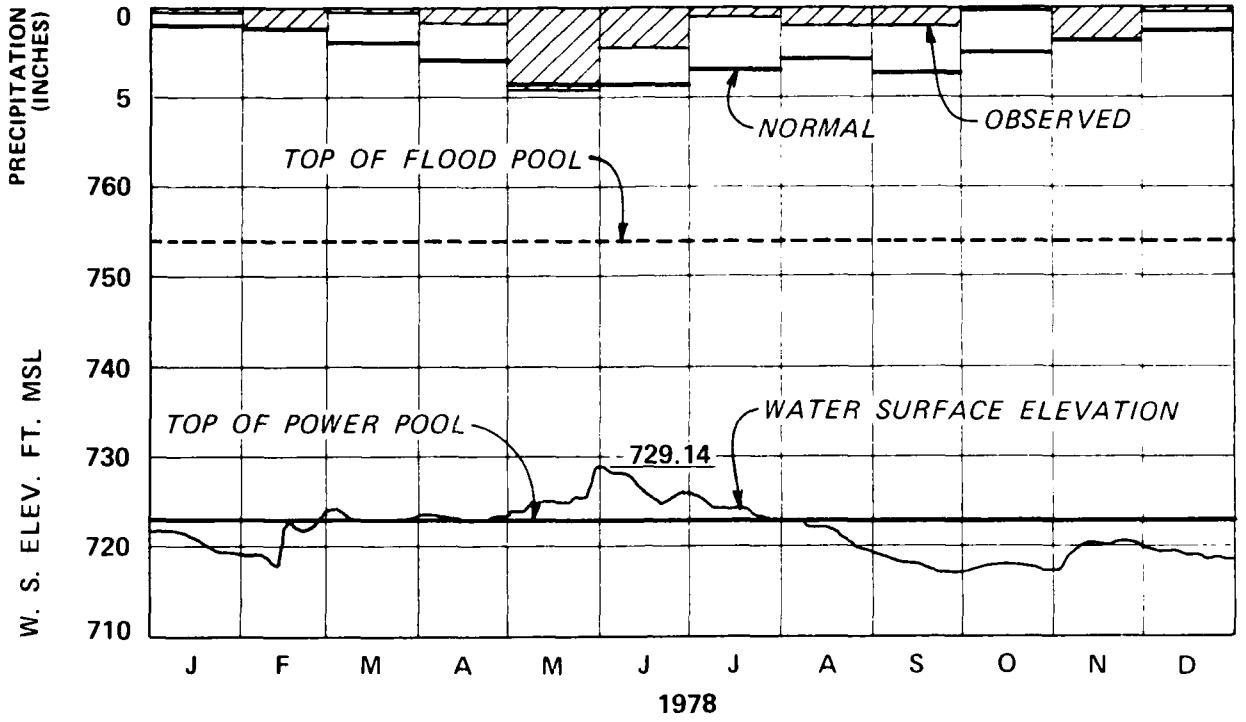


PLATE 8

KEYSTONE RESERVOIR



FALL RIVER RESERVOIR

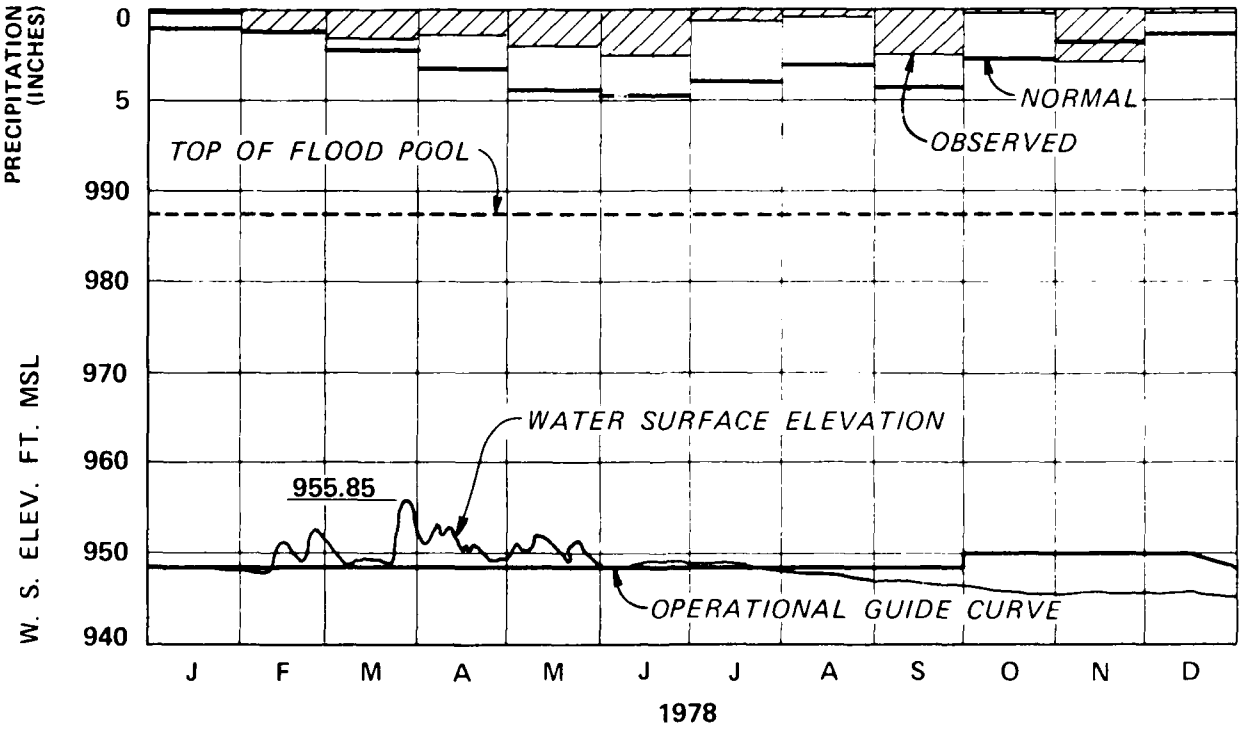
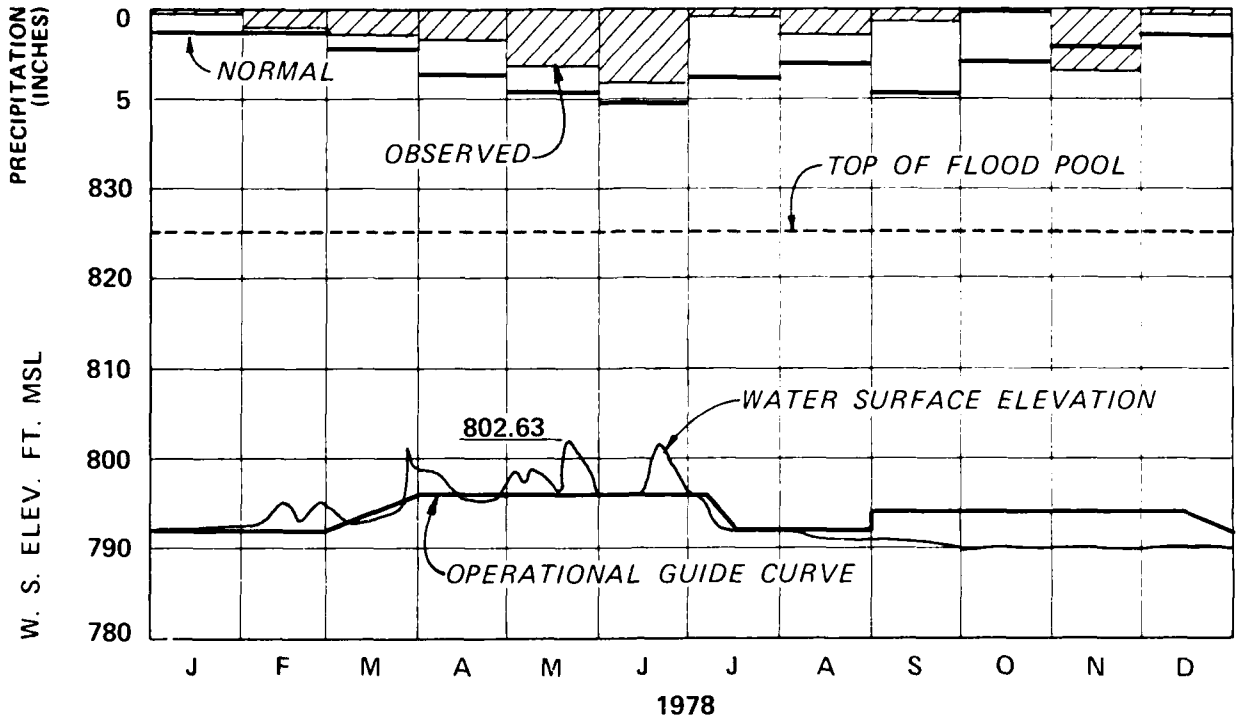


PLATE 9

ELK CITY RESERVOIR



OOLOGAH RESERVOIR

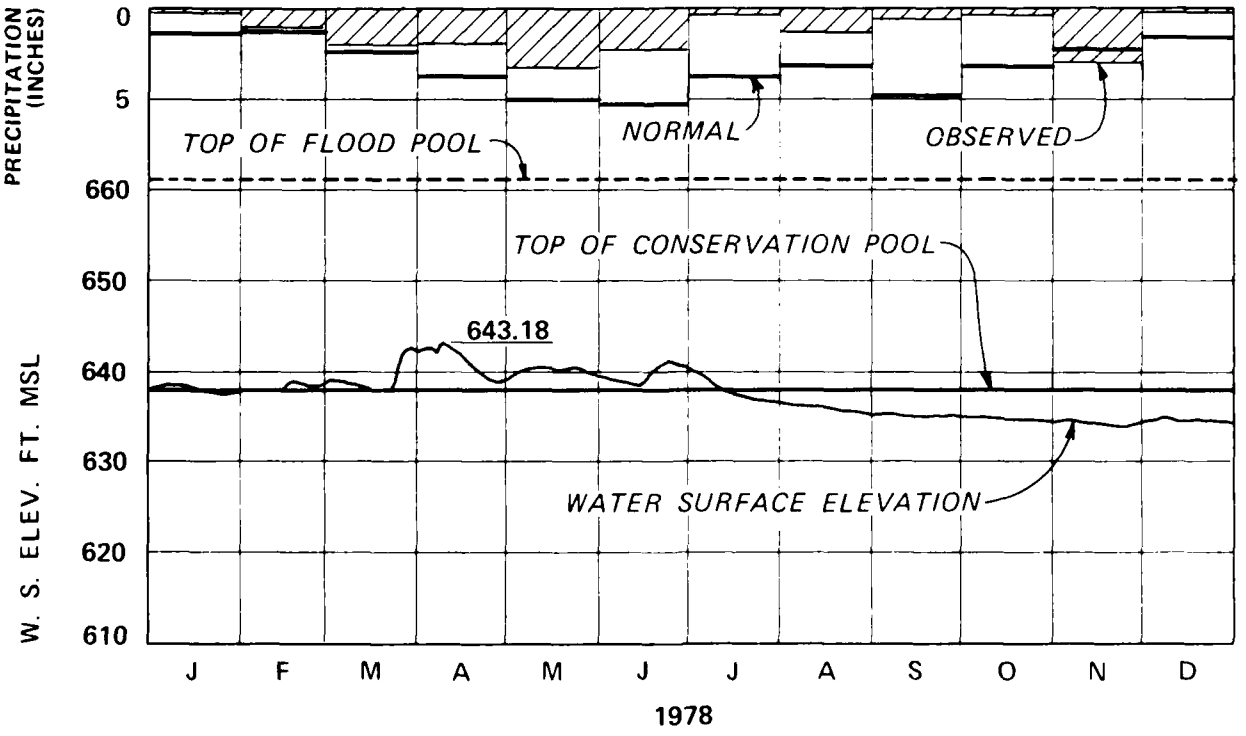
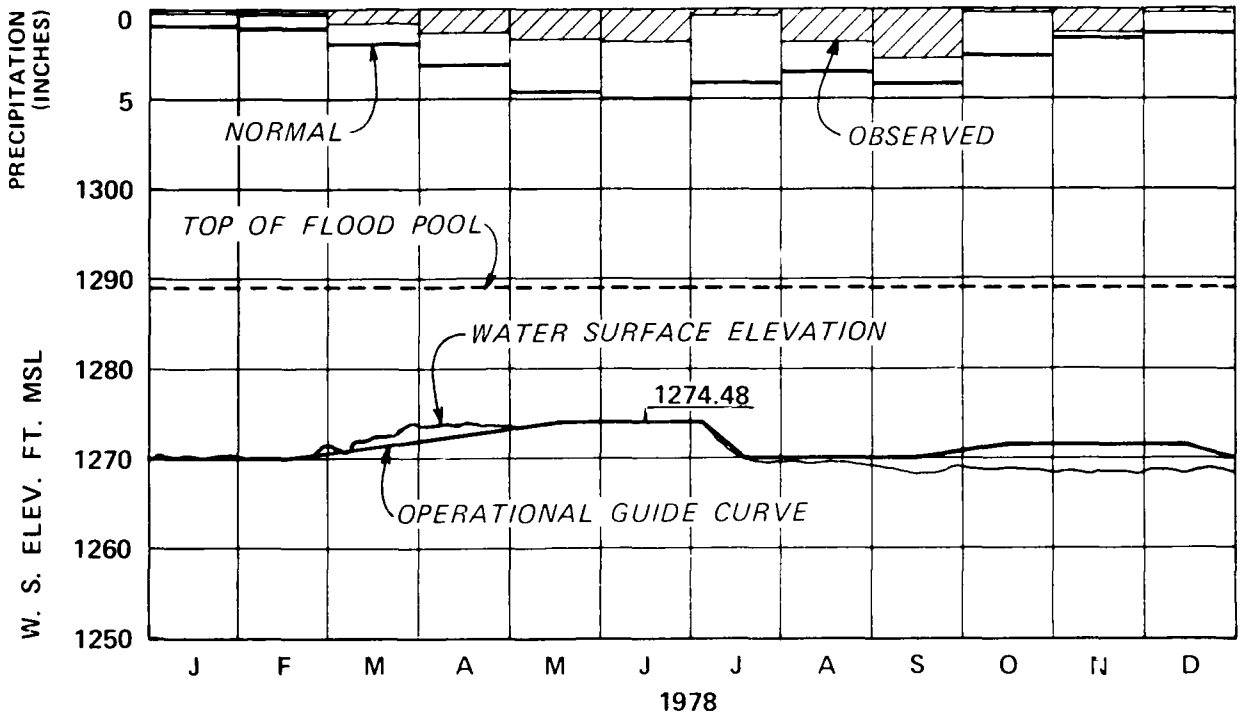


PLATE 10

COUNCIL GROVE RESERVOIR



JOHN REDMOND RESERVOIR

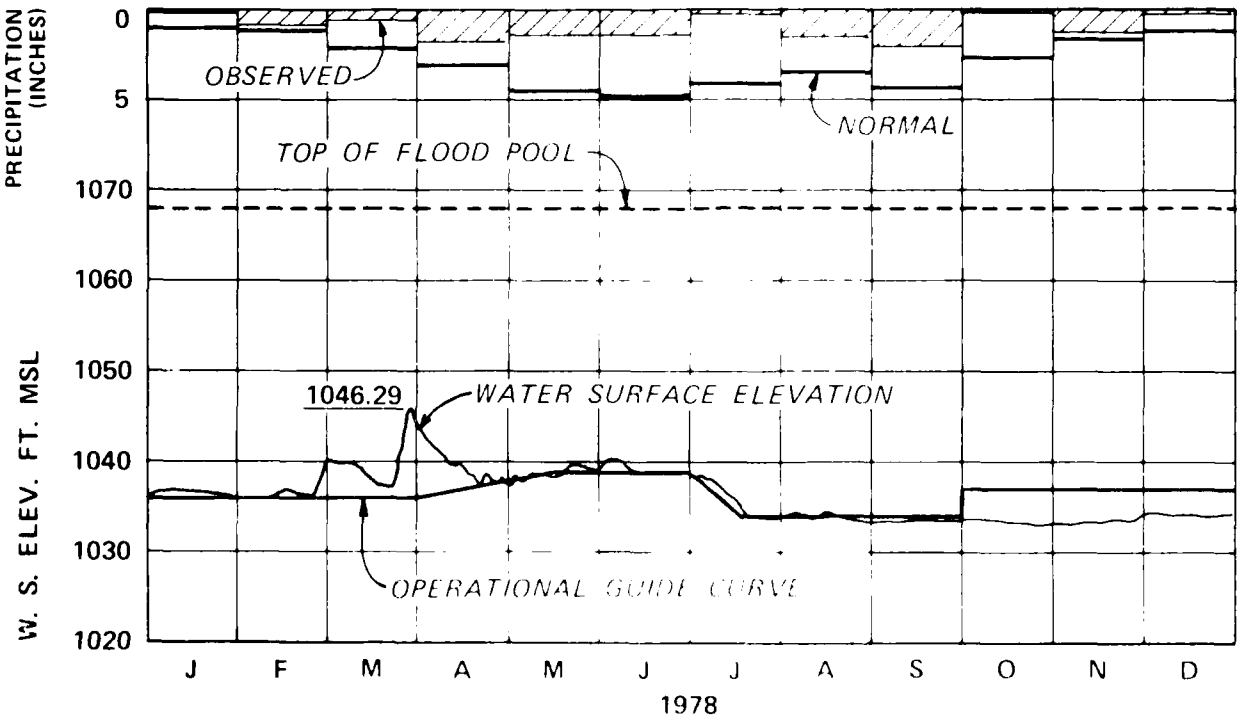
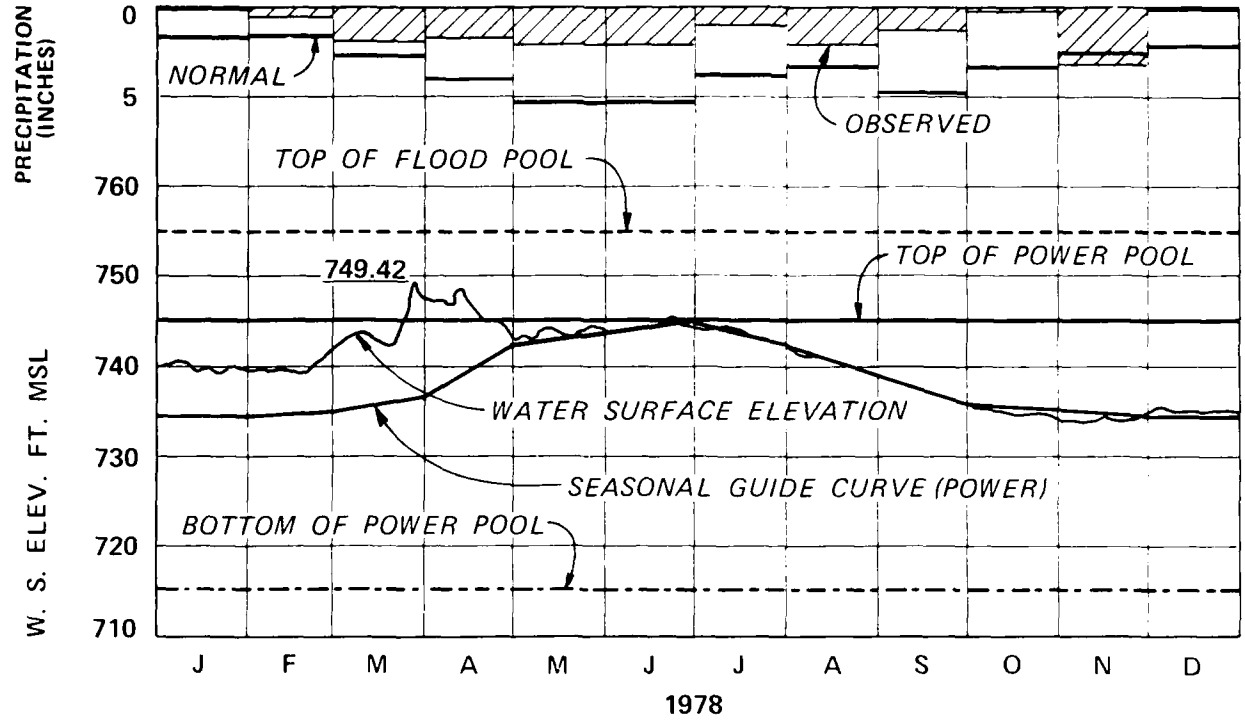


PLATE 11

GRAND LAKE (PENSACOLA) RESERVOIR



FT GIBSON RESERVOIR

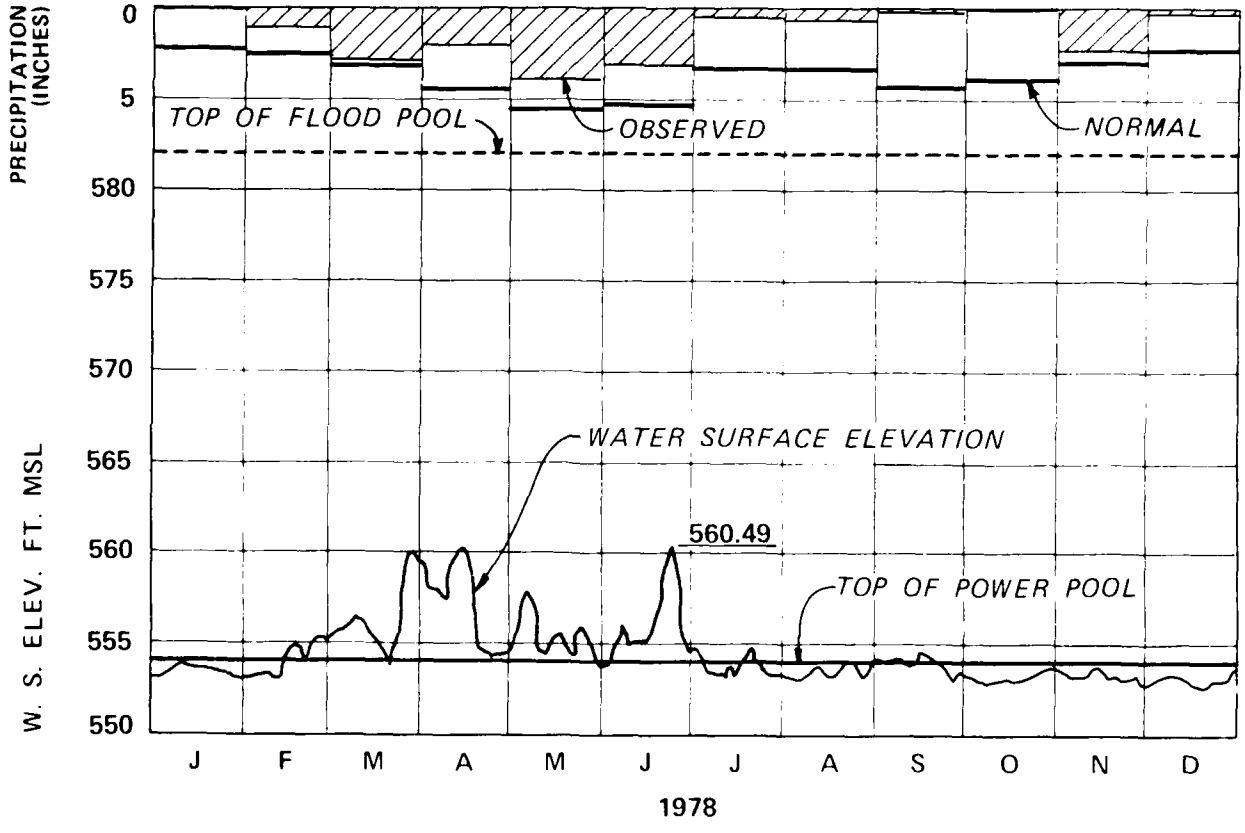


PLATE 12

TENKILLER RESERVOIR

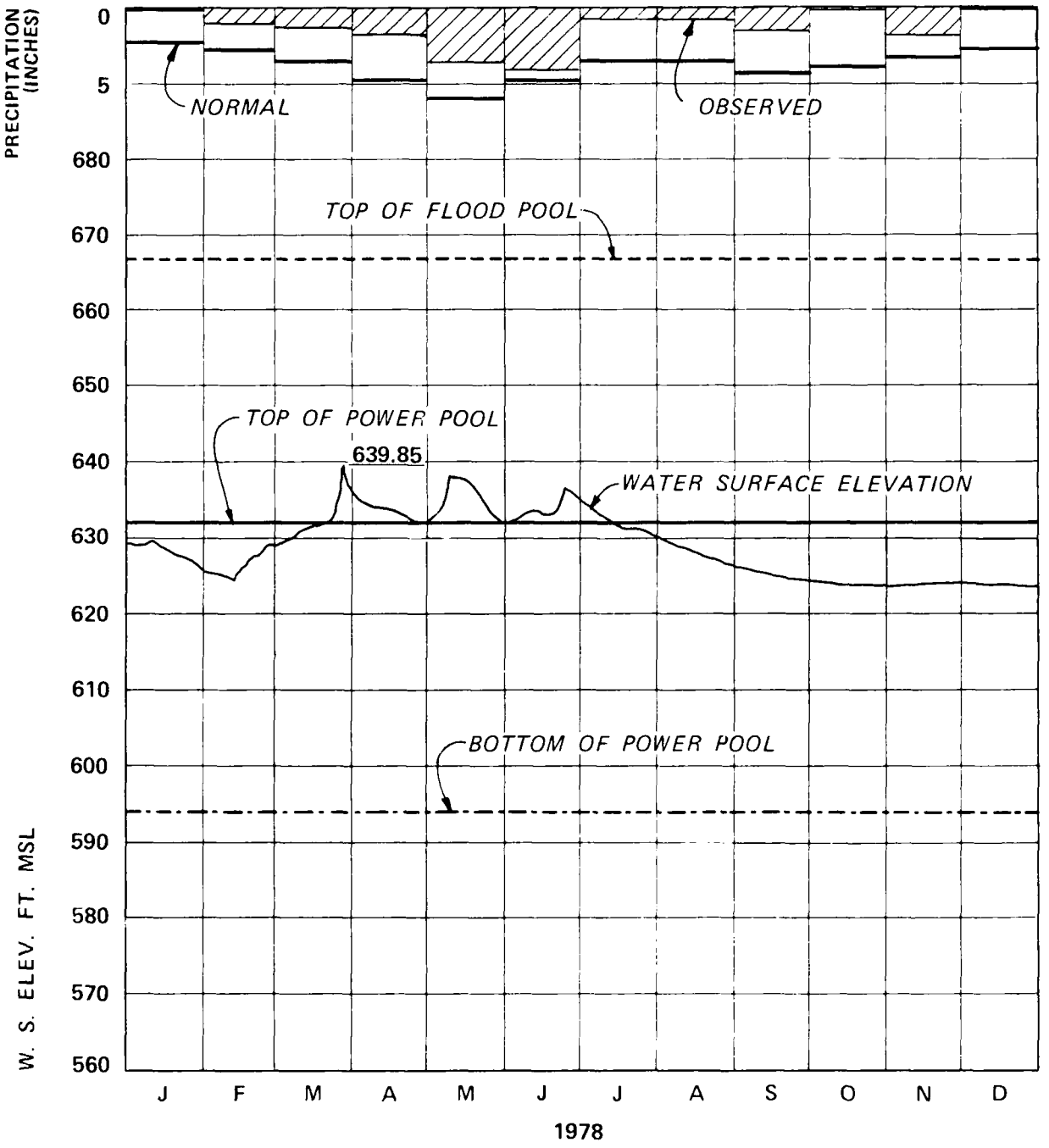
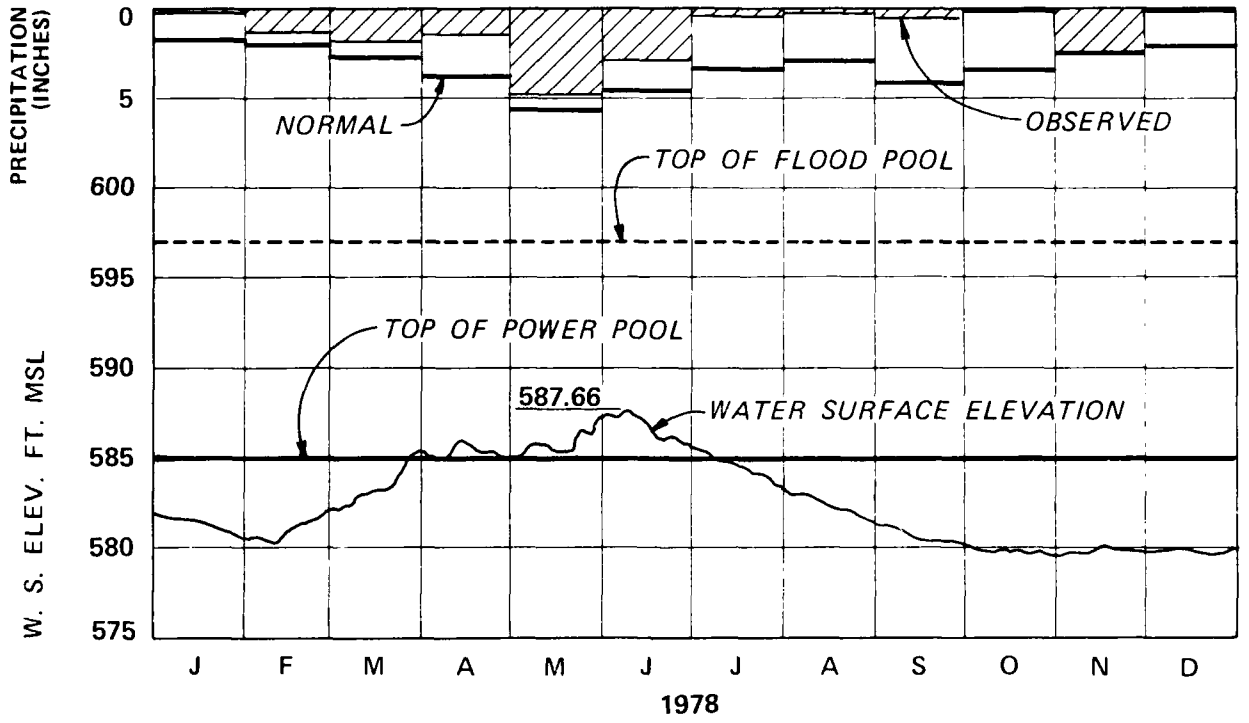


PLATE 13

EUFAULA RESERVOIR



WISTER RESERVOIR

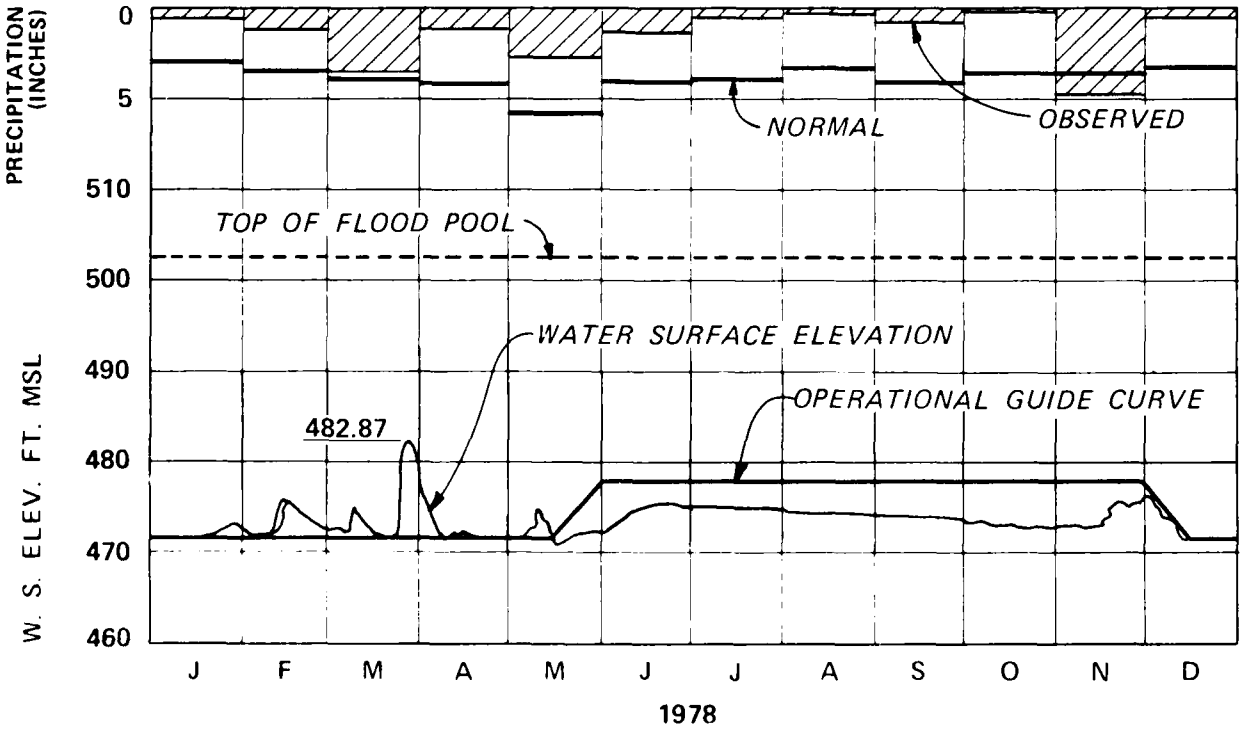
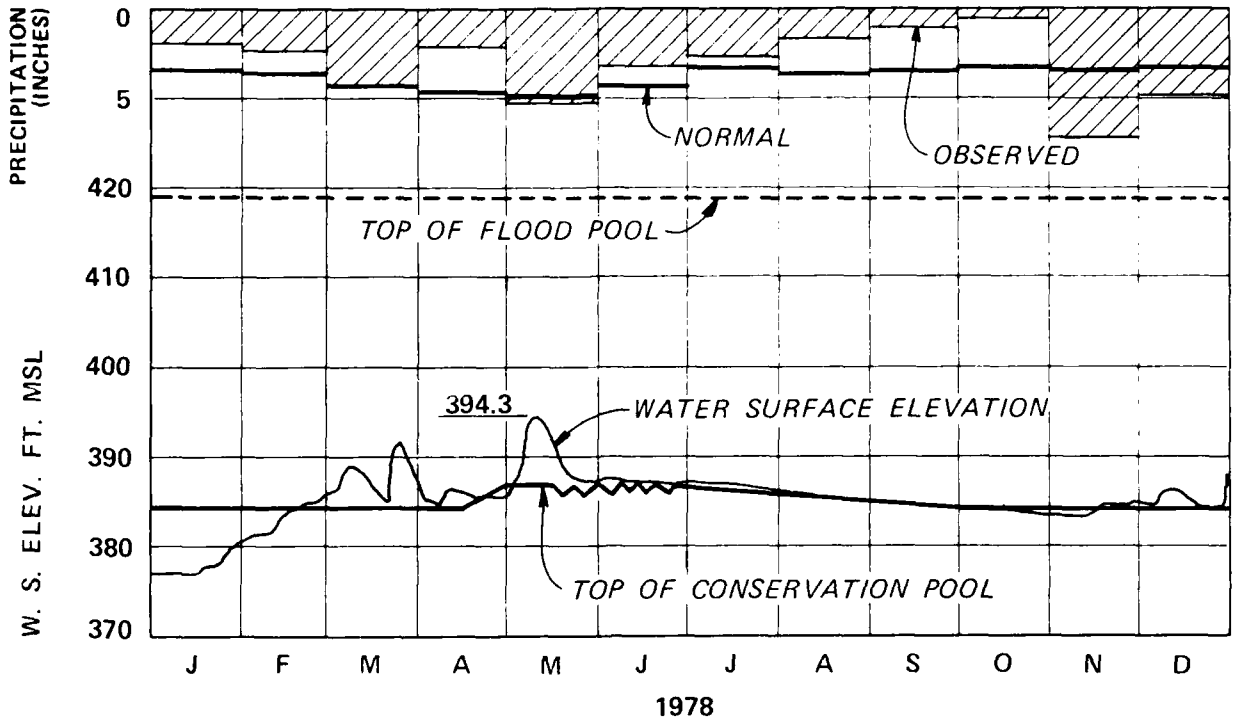


PLATE 14

BLUE MOUNTAIN RESERVOIR



NIMROD RESERVOIR

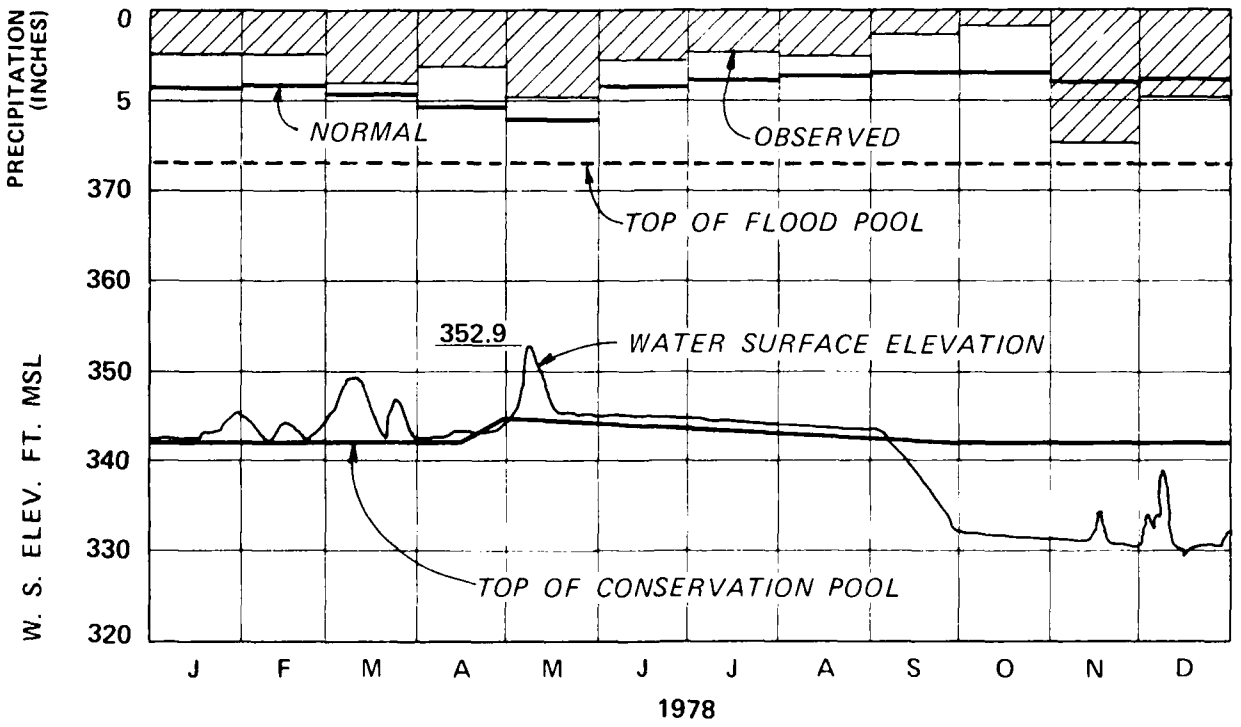


PLATE 15

FLOOD DAMAGES PREVENTED

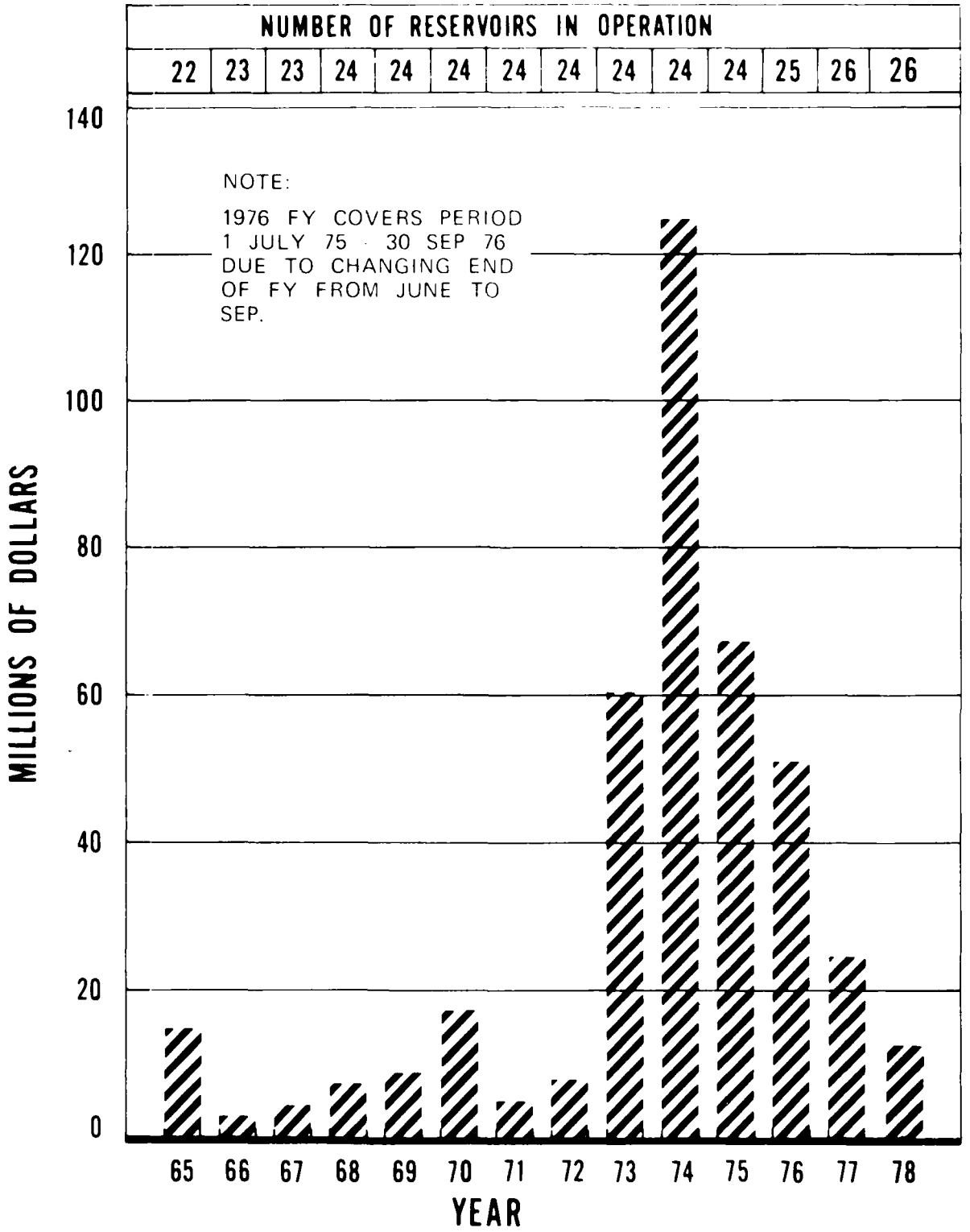
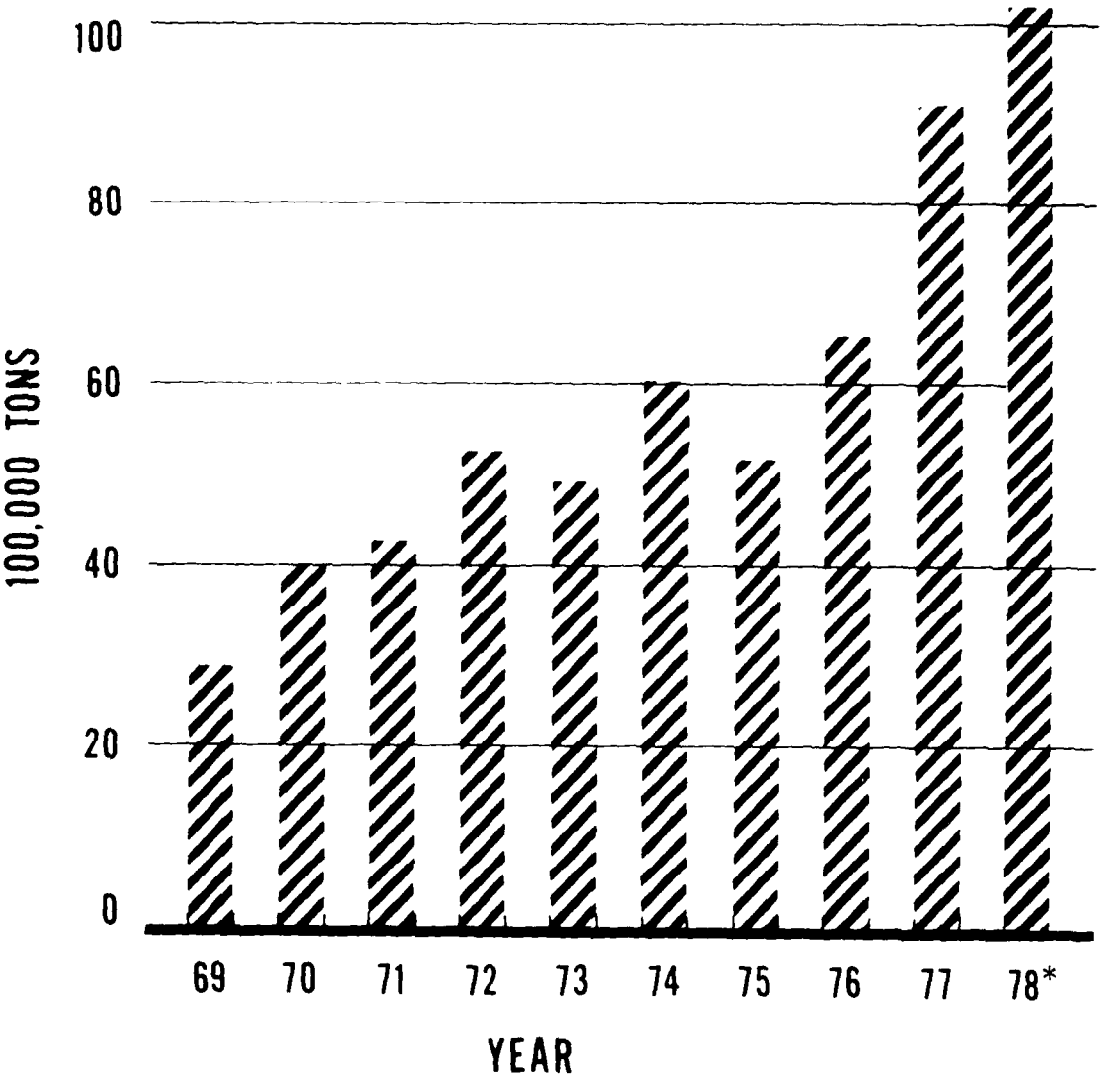


PLATE 16

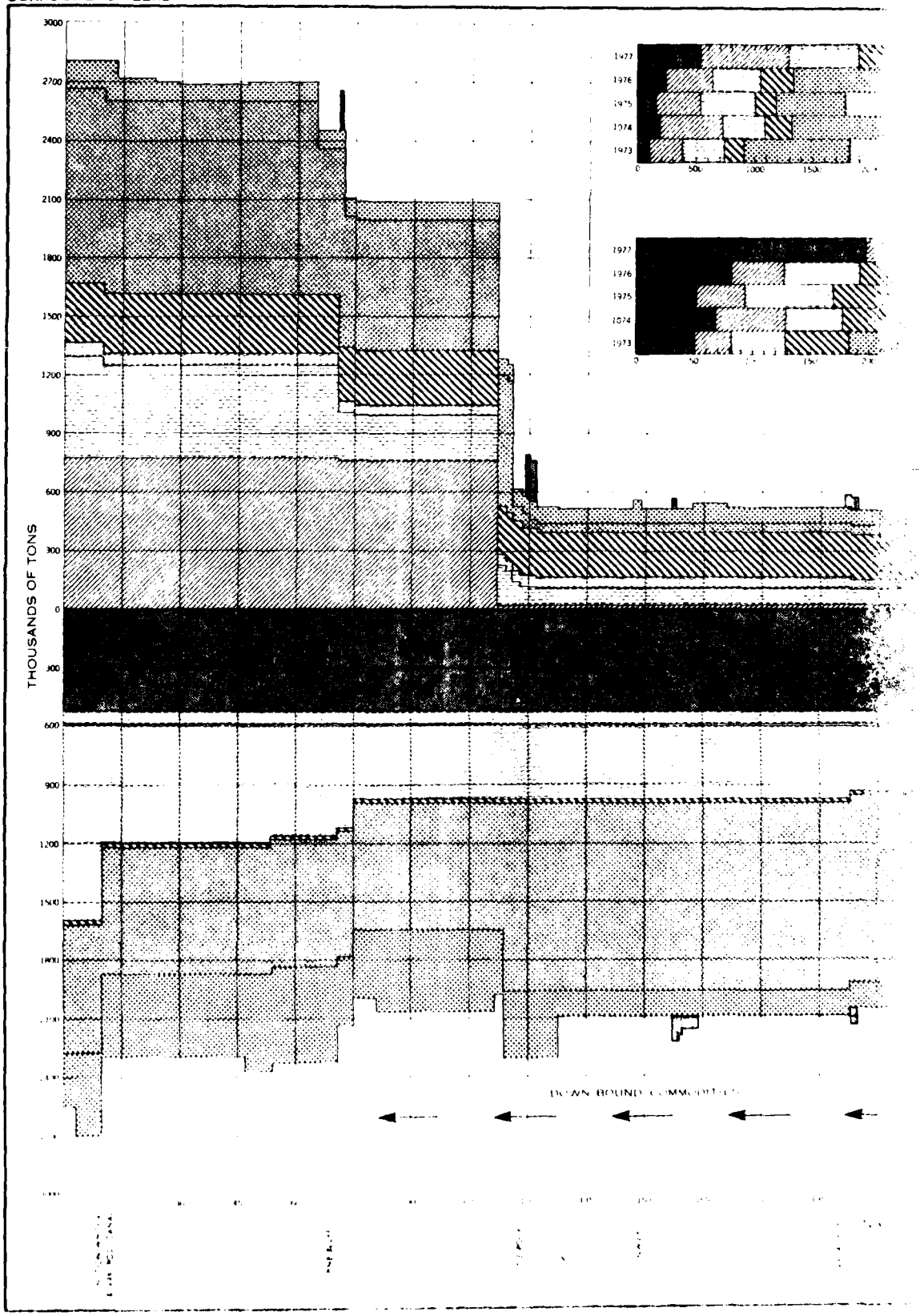
FREIGHT TRAFFIC
McCLELLAN-KERR ARKANSAS RIVER NAVIGATION SYSTEM
MOUTH OF WHITE RIVER TO PORT OF CATOOSA, OKLA

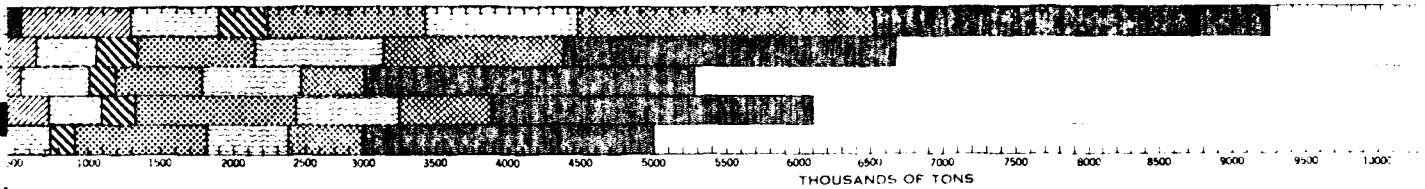


*Tonnage for 1978 based on preliminary estimates.

PLATE 17

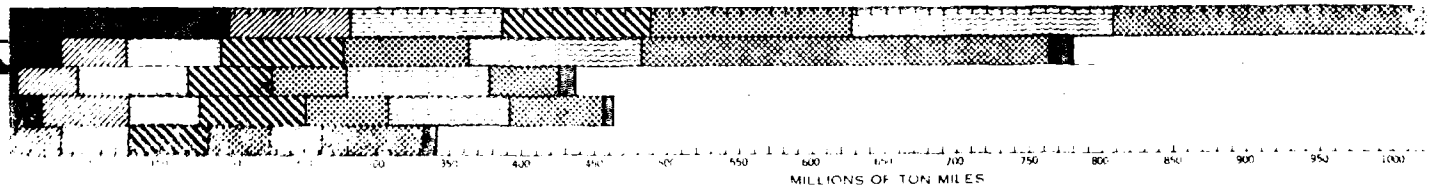
CORPS OF ENGINEERS





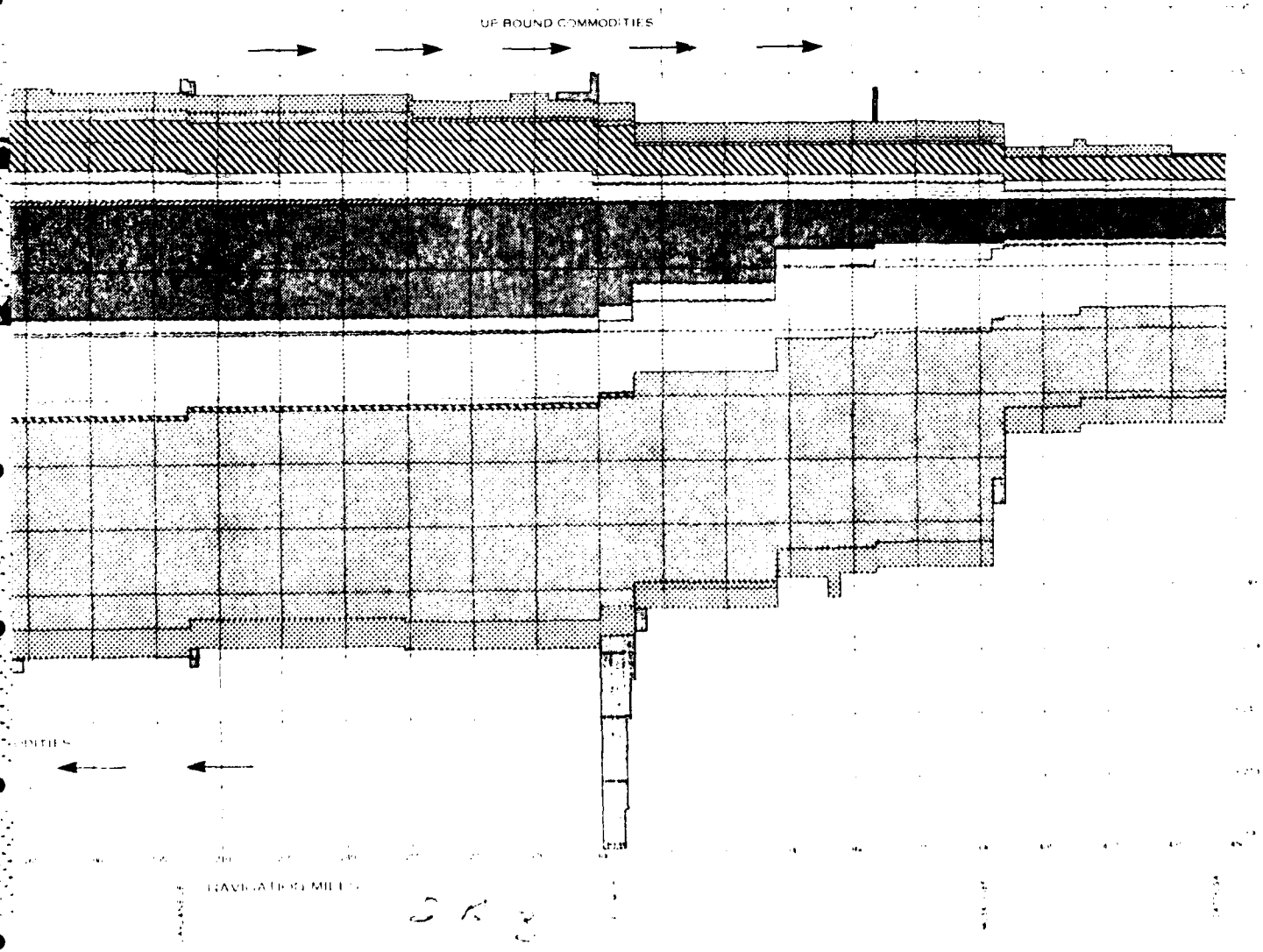
THOUSANDS OF TONS

COMPARISON OF TONNAGE

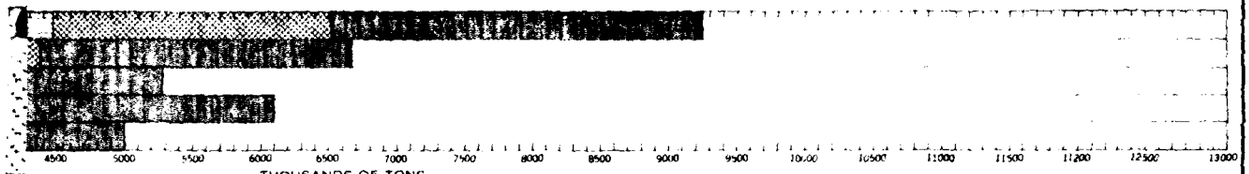


MILLIONS OF TON MILES

COMPARISON OF TON MILES

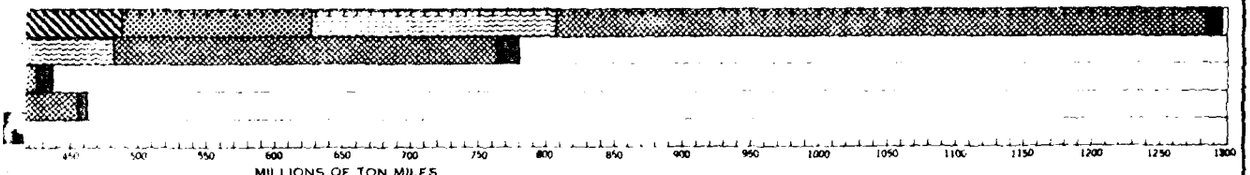


U S ARMY



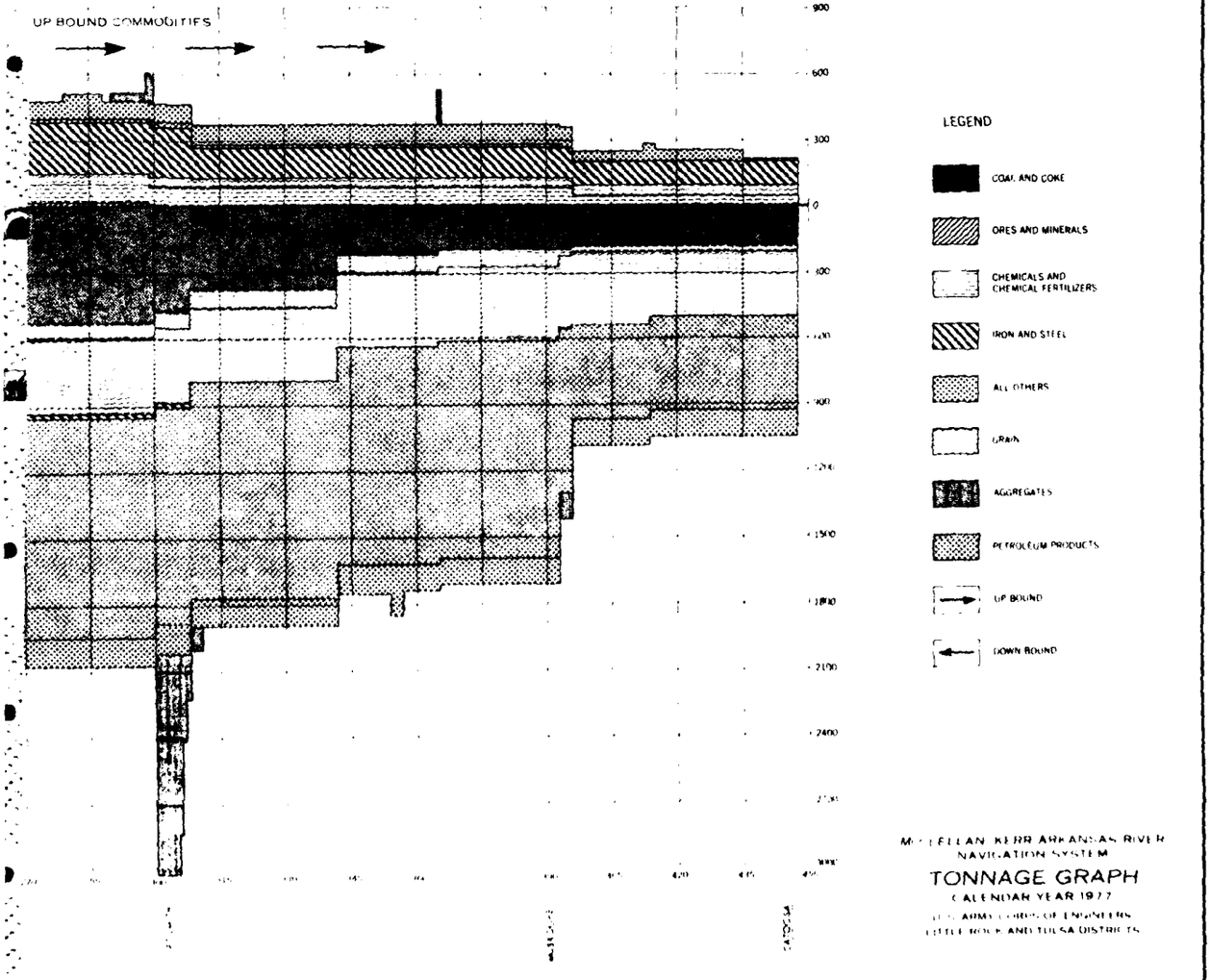
THOUSANDS OF TONS

COMPARISON OF TONNAGE



MILLIONS OF TON MILES

COMPARISON OF TON MILES



MCCLELLAN-KERR ARKANSAS RIVER NAVIGATION SYSTEM

TONNAGE GRAPH

CALENDAR YEAR 1977

U.S. ARMY CORPS OF ENGINEERS
LITTLE ROCK AND TULSA DISTRICTS

PLATE 18

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COMMODITY GROUPS, TONNAGE, AND TON MILEAGE

Group	Commodities Included	Tonnage	Ton Mileage
Coal and coke	Coke, petroleum [illegible]	15,484	
	Coal and lignite	515,285	
		530,769	197,736,886
Aggregates	Limestone	11,000	
	Sand, gravel, crushed rock	2,745,228	
		2,756,228	11,803,446
Grains	Corn	10,869	
	Wheat	357,776	
	Soybeans	619,598	
	Rice	44,632	
	Sorghum grain	6,216	
		[illegible],039,091	179,805,73[illegible]
Chemicals and chemical fertilizers	Sodium hydroxide (caustic soda)	183,165	
	Alcohols	13,668	
	Benzene and toluene, crude and commercially pure	6,775	
	Basic chemicals and products not elsewhere classified	47,863	
	Synthetic rubber	3,941	
	Nitrogenous chemical fertilizers, except mixtures	164,560	
	Phosphatic chemical fertilizers, except mixtures	5,108	
	Fertilizer and fertilizer materials, not elsewhere classified	158,257	
	Potassic chemical fertilizers	12,070	
		545,425	106,64[illegible],5[illegible]
Ores and minerals	Bauxite and other aluminum ores and concentrates	[illegible]	
	Nonmetallic minerals, except fuels, not elsewhere classified	5,964	
	Nonferrous ores, concentrates [illegible]	2,296	
		[illegible]	[illegible],973,4[illegible]
Iron and steel	Iron and steel [illegible], including [illegible] tube and pipe, and sponge iron	[illegible],293	
	Iron and steel shapes, except [illegible]	52,[illegible]	
	Iron and steel plates and sheets	196,952	
	Iron and steel [illegible] and tube	33,179	
	Ferroalloys	2,429	
	Primary iron and steel products, not elsewhere classified	[illegible],273	
	Iron and steel scrap	10,[illegible]	
		[illegible],657	[illegible]
Petroleum products	Distillate fuel oil	[illegible]	
	Gasoline	[illegible]	
	Residual fuel oil	[illegible]	
		[illegible],737,[illegible]	[illegible],026,59[illegible]
All other	Asphalt, tar, and [illegible]	[illegible]	
	Prepared animal feeds	[illegible]	
	Molasses	[illegible]	
	[illegible]	[illegible]	
	Lumber	[illegible]	
	Slag	[illegible],908	
	[illegible]	[illegible]	
	Paper and paper [illegible]	[illegible]	
	Crude Petroleum	[illegible]	
	Fabricated metal products	[illegible],381	
	Machinery, except electrical	[illegible]	
	Phosphate rock	[illegible]	
	Materials used in waterway improvement, government materials	[illegible]	
	Hay and fodder	[illegible]	
	Timber, posts, poles [illegible]	[illegible]	
	Pulp and paper [illegible]	[illegible]	
	Grain mill products, NEC	[illegible]	
	Electrical machinery and [illegible]	[illegible]	
	Veneer, [illegible]	[illegible]	
	Vegetable [illegible]	[illegible]	
	Glass and [illegible]	[illegible]	
	Stone and [illegible]	[illegible]	
		[illegible]	[illegible],184
	TOTAL TONNAGE	[illegible],956	
	TOTAL TON MILEAGE		[illegible]

Minutes

ARKANSAS RIVER BASIN
COORDINATING COMMITTEE MEETING

Dallas, Texas
4 April 1978

1. Introduction. Mr. R. Terry Coomes, Chairman of the Committee, opened the meeting and introduced those in attendance. A list of attendees is furnished on inclosure 1. The Committee was organized in 1970 and at that time the Arkansas Basin system was the number 1 water management problem in the Southwestern Division (SWD). Most of the planning and operation studies for the projects were done in the 1940's and early 1950's, so when the system was nearly complete in 1970, the conditions which existed during initial planning had changed substantially. During the planning, the channel capacity at Van Buren was considered to be 150,000 cfs. By 1970, when the system was in operation phase, problems were identified at the 105,000 cfs level. The flood control operation was very complex due to tandem and parallel reservoirs and the different needs affecting each reservoir. The reliability of the navigation system was being questioned at that time due to shoaling and velocity effects at high flows. The demands on hydropower were increased due to the energy situation. Also, the compact between Arkansas and Oklahoma was just being completed. So, in the 1970's, when we started this Committee, we had many problems that needed our attention. During the past seven years there has been a great deal of effort directed toward solving these problems. The system operating study has been completed and the regulation manual is being prepared. At this point the major problems that this Committee had to deal with have been resolved and we are dealing with more routine operations now.

2. Minutes from 1977 meeting. The minutes were accepted as published in the "Report on 1977 Activities."

3. Review of 1977 operations.

a. Above Fort Smith. Mr. Ross R. Copley, Corps of Engineers, Tulsa District, reviewed last year's operations above Fort Smith. At the beginning of the year all projects were at or below the top of conservation pool. Although the runoff was below normal for the year, large storms in March, May, June, and November produced enough runoff to require flood control operations. The largest utilization of flood storage occurred during the late June and July storms. Projects in the Verdigris Basin utilized from 30 to 76 percent of their flood storage and those in the upper Grand Basin ranged from 22 to 66 percent.

Lesser amounts were utilized in most of the other projects in the Arkansas Basin. The total runoff at the Van Buren gage during the year was 15.1 million acre-feet as compared to a normal of 23 million acre-feet.

(1) During the fiscal year ending 30 September 1977, it was estimated that the flood control reservoirs prevented about $24,624,000 in flood damage in the Arkansas Basin.

(2) Preliminary estimates indicate that the tonnage on the Tulsa District portion of the navigation system for 1977 was up 55 percent from 1976. Commodities showing the most significant increases were coal and chemical fertilizer, both up over 100 percent. Maintenance dredging in the Tulsa District amounted to approximately 402,000 cubic yards. Power generation during the year was less than the average for the last five years. However, the generation for 1977 was higher than 1976. Recreation interest continued strong at the projects with visitation up about 13 percent over 1976. During the year, 53,914 acre-feet of water was supplied from storage which was about 28 percent less than the amount supplied in 1976. The seasonal operation of the Kansas projects was continued with a slight modification from 1976. These seasonal operations for the benefit of fish and water fowl have been in effect for the past several years.

(3) One new project, Birch Lake, was placed in operation.

b. Below Fort Smith. Mr. William E. Isaacs, Corps of Engineers, Little Rock District, reviewed highlights of last year's operations below Fort Smith. The year was fairly uneventful on the main river. This was probably helped by below normal rainfall in the lower basin. The principal deviation from normal regulation for the year was at Blue Mountain Lake. In cooperation with the Arkansas Game and Fish Commission, the lake was lowered about 10 feet last June to allow removal of rough fish, improvement of the game fishery, and reduction of turbidity in the lake. The exposed lakebed was seeded with a sorghum-sudan hybrid in the summer. The rough fish were killed in early October and restocking of game fish was started in late October. There was not much flood control activity during the year. There were only two or three minor rises. Details of these are shown in the report. Another new record was set for navigation on the Arkansas River. Tonnage increased about 40 percent over 1976. Flow conditions were excellent for navigation except for just a few days. There were some problems on the lower 10 miles of the river due to low flows on the Mississippi River. Maintenance dredging amounted to only 1.7 million cubic yards which was less than 1976. Power production at Dardanelle and Ozark increased 30 percent over 1976. Recreation continued at a high level on the main Arkansas. Fifty-seven of the 76 planned parks have been completed and all are expected to be completed

in FY 1981. The Arkansas River water quality continues to improve. Some areas are meeting the state standards for contact water recreation sports. In summary, last year was a typical low flow year.

4. Status of the Oklahoma Comprehensive Water Plan. Mr. Rick A. Smith, Oklahoma Water Resources Board, presented a brief history of the Oklahoma Comprehensive Water Plan, the current status of the Plan, and a report on a Senate Bill now pending in the Oklahoma legislature which could be the first step towards the development of a statewide water system. A copy of this presentation is included as inclosure 2.

5. Effects of Water Level Management on Walleye and Other Coolwater Fish in Kansas Reservoirs. Mr. John A. Henderson, Kansas Water Resources Board, presented a talk and slides on the effects of water level management in Kansas lakes. Kansas has been involved in water level management of lakes since 1970. This practice was initiated on Council Grove Lake and has been expanded to 13 Kansas lakes. Six of these lakes are in the Tulsa District. The objective of water level management is to recreate on a small scale the conditions which occur in newly impounded reservoirs which are good for fish propagation. The typical effects of the newly impounded reservoir are increased reproductive rates for fish, high survival of the offspring, rapid growth, and increased fishing success. Fishing success usually drops off within about three years after impoundment unless water level management practices are used. Typical water level management plans have a gradually rising water level in the spring to inundate vegetation and rocky areas for spawning and nursery habitat; a relatively stable water level into early summer; and a midsummer drawdown to allow a lush growth of vegetation. The results of water level management may not be evident until a year or more after implementation. Due to uncontrollable weather conditions and inflows, a plan may have to be implemented for several years to achieve the desired results. In Kansas lakes the drawdowns are 10-20 percent of the total surface area to allow vegetation growth on the exposed drawdown area. Natural vegetation and seeded vegetation are both used, with Japanese millet providing good results. Aerial seeding is used on large areas and hand seeding on smaller areas. Decomposition of the vegetation during the summer inundation period stimulates plankton growth and reduces turbidity. Slides were presented showing the results of management practices at Milford Lake where game fish populations tripled while populations of rough fish remained stable or declined.

6. Arkansas River Basin System Water Control Plan. Mr. Copley, Tulsa District, Corps of Engineers, presented a review of the system water control plan. This plan was selected as the best of 23 different plans which were studied using a computer reservoir regulation model referred to as "SUPER." Daily flow data for the period 1940

through 1974 at 20 lakes and 18 control stations was used in the model to evaluate the effect of various water control plans. The selected plan which was developed in a joint effort by the SWD, Tulsa, and Little Rock Districts, is designed to achieve a reasonable balance of the congressionally authorized purposes for which the lakes are operated. To assist in system operation, individual lake operational guide curves, system balancing of flood control storage, and a seasonal guide curve for the Van Buren gage were developed. The regulating schedules provide that certain stages are not to be exceeded insofar as possible at specific locations on the Arkansas River and tributaries below the flood control lakes. The individual lake guide curves define the maximum flood control release normally expected from a particular project. The maximum release rates are variable, depending upon the amount of total lake flood control storage utilized. A balancing scheme has been developed to assist in scheduling releases from individual lakes. This will assign priority and amount of release depending on the flood control storage used at each lake. The guide curve for the regulated flow at Van Buren, Arkansas, is dependent upon the season of the year and the equivalent percent of basin flood storage utilized. The equivalent percent of basin flood storage utilized is defined as the next three days inflow forecasted into Kaw, Keystone, Oologah, Tenkiller, Eufaula, Fort Gibson, Markham Ferry, Pensacola, Hulah, and Wister Lakes, plus the current flood storage utilized in each project divided by the total flood control storage in these projects (7,494,500 acre-feet). The target flow at Van Buren varies with the equivalent percent of basin storage utilized as shown on the guide curve.

The Van Buren guide curve will govern the regulation of the lakes that discharge directly into the main stem of the Arkansas River. The upstream lakes will be operated as subsystems. These subsystems will consist of the Upper Grand (Neosho), Lower Grand (Neosho), Verdigris, and Upper Arkansas. Details of this plan are included in the Master Water Control Plan for the Arkansas River Basin.

7. Discussion Topics.

a. Status of Arkansas River Master Water Control Manual. Mr. Carroll Scoggins, Tulsa District, reported that the manual is expected to be completed by late summer this year. The following requests were received for the manual: Kansas, Oklahoma, Arkansas, Interior (3), and Lower Mississippi Valley Division.

b. Van Buren Channel Study. Mr. Scoggins reported that the study which involved the reach of the Arkansas River from Lock and Dam No. 13 to W. D. Mayo Lock and Dam was forwarded to higher authority in July 1977. In recent years, the channel capacity has decreased so that only about 105,000 cfs can be passed at a stage of 22 feet as compared to 150,000 cfs used in the design of the upstream

flood control system. The objective of the study was to consider possible solutions for restoring the design flow of 150,000 cfs. Both structural and non-structural alternatives were considered. The plan selected is the acquisition of flow easements on lands subject to net damage from project operation because of increased duration. The net damage areas would be outside the navigation servitude boundary and would not include lands which have been benefited by being preserved or established as a result of dikes and revetments constructed along the navigation channel. The preparation of a real estate design memorandum by the Little Rock District is underway and this should be completed this fall.

c. Construction Activities in the Basin. Mr. Scoggins reported that they presently have six projects under construction in the basin.

(1) Candy Lake on Candy Creek - impoundment scheduled 1982.

(2) Big Hill Lake on Big Hill Creek - impoundment scheduled 1980.

(3) Copan Lake on Little Caney River - impoundment scheduled 1979.

(4) El Dorado Lake on Walnut River - impoundment scheduled 1980.

(5) Optima Lake on Canadian River - impoundment scheduled 1978.

(6) Skiatook on Hominy Creek - impoundment scheduled 1981.

The only other construction is channel improvement in Tulsa on Joe Creek. This is scheduled for completion in 1980.

d. Hydropower Operations. Mr. Kendall Kerr, Southwestern Power Administration (SWPA), reported they are working on improved procedures for obtaining purchases power money. They are also in the process of asking for a rate increase. This announcement is to be in the Federal Register about the middle of April and allow about 90 days for reaction to the announcement.

e. Status of Automated Data Collection System. Mr. Scoggins reported that the system was approved last December. They are now in the process of obtaining funding for the system. When funding is obtained plans are to complete the system over a three-year period.

8. Summary. The general feeling of the Committee members was that the Committee should continue to have the report prepared. It was brought out that the report should describe the compacts in the area, i.e., Kansas - Oklahoma, and Arkansas - Oklahoma. Also, consideration should be given to a section dealing with the 404 permits. On the

question of continuation of the Committee in its present form, the consensus was that it should continue without any change. Plans are to have a meeting again next year in Dallas, Texas.

9. Adjourn.

2 Incl
1. Attendance List
2. Status of the Oklahoma
   Comprehensive Water Plan

ATTENDANCE LIST

Arkansas River Basin Coordinating Committee Meeting
4 April 1978
Dallas, TX

COMMITTEE MEMBERS

Terry Coomes, Chairman	Corps of Engineers, Southwestern Division
Randy Young	Ark Soil & Water Conservation Commission
John A. Henderson	Kansas Water Resources Board
Rick A. Smith	Oklahoma Water Resources Board
Douglas Edwards	Soil Conservation Service, Little Rock
K. B. Schroeder	Department of the Interior
Kendall Kerr	Southwestern Power Administration
Arthur Martin	Federal Energy Regulatory Commission, Fort Worth

OTHERS

Charles Sullivan	Corps of Engineers, Southwestern Division
John R. Parks	Corps of Engineers, Southwestern Division
William E. Isaacs	Corps of Engineers, Little Rock District
Carroll Scoggins	Corps of Engineers, Tulsa District
Fred Becker	Corps of Engineers, Tulsa District
Ross Copley	Corps of Engineers, Tulsa District
Warren L. Sharp	Corps of Engineers, Lower Mississippi Valley Division
Arthur C. Laurent, Jr.	Corps of Engineers, New Orleans District
Tom E. Harrington, Jr.	Corps of Engineers, New Orleans District

STATUS ON THE OKLAHOMA COMPREHENSIVE WATER PLAN
APRIL 4, 1978

The Planning Division of the Oklahoma Water Resources Board is currently involved in the preparation of Phase II of the Oklahoma Comprehensive Water Plan. There are actually a number of tasks with which we are dealing with at this time, but the Phase II report takes precedence over all other issues.

This morning, I would like to present to the committee a brief history of the Oklahoma Comprehensive Water Plan, the current status of the Plan, and finally a report on a Senate Bill now pending in the Oklahoma legislature which could be the first step towards the development of a truly statewide water system.

Although the Water Board has been working on a State Water Plan since 1964, the actual directive to prepare what we're calling Phase I and Phase II of the Oklahoma Comprehensive Water Plan came from the Oklahoma legislature in 1974. The Plan, when complete will identify water development projects needed to meet projected water demands to the year 2040 - - - it's a 50-year plan.

The Phase I Plan, which covered the Southern 33 counties in the State or basically the Red River Basin was completed and submitted to the Legislature in 1975. We're currently working on the Northern 44 counties in the Arkansas Basin to complete what we're calling the Phase II Plan.

The State Water Plan studies were divided in such a manner because of the immediate water needs of central Oklahoma, including Oklahoma City and the metropolitan area and the abundance of information available on the water resources of the Red River Basin.

The coordination of local, state and Federal agencies was deemed necessary for such a study. The Federal agencies participating include the Corps of Engineers, Bureau of Reclamation, Soil Conservation Service, US Geological Survey and numerous state agencies and local organizations are working with us.

After extensive economic and engineering feasibility studies were completed, three alternative plans were designed. Of these three, one was chosen as the most suitable project. The main feature of the Phase I Plan is an interconnected system which would transport surplus water from the Kiamichi and Muddy Boggy Rivers in southeastern Oklahoma to central and southwestern parts of the state. The overall cost of the Phase I Interconnected System based on 1974 prices is approximately $2.0 billion. The system would have an ultimate water conveyance capacity of 1,308,000 acre-feet/year or 1,164 mgd. 433 mgd will be

transported to central Oklahoma for M&I purposes and the remaining 731 mgd diverted to southwestern Oklahoma primarily for irrigation purposes.

Under Federal evaluation criteria, the municipal and industrial water supply portion of the interconnected system is economically justified. However, the irrigation portion of the transfer system is not economically justified. Therefore, if the irrigation component of the system is to ever develop, the state must be prepared to assume a major portion of the costs which would not be justified under the Federal criteria.

We have a somewhat unique situation in Oklahoma in that the Corps of Engineers and the Bureau of Reclamation are both working together on our comprehensive plan.

The Corps of Engineers is presently preparing authorizing documents on the Central Oklahoma Project (COP) which is the portion of the Phase I conveyance facility from southeastern to central Oklahoma. The Bureau is continuing studies on the portion of the conveyance facility from central Oklahoma westward.

As I mentioned, the Phase I report was submitted to the Legislature on September 1, 1975. However, it was not adopted by the Legislature, due to some severe, yet in some ways, valid criticism. The controversy over the East to West trans-basin diversion of water has also prompted the inactivity by the Legislature. There can be no doubt that the Phase I report was not a panacea for Oklahoma's water problems. However, considering the brief time allotted and the lean appropriations for its financing, the Phase I report was a remarkable document.

That's enough on the Phase I Plan, now for Phase II. Phase II of the water plan was begun as soon as Phase I was submitted to the Legislature. The original planning schedule provided that the Phase II plan be submitted in its entirety to the Legislature in September 1977. However, several major problems have caused the planning schedule to be altered. An Interim Report was prepared in lieu of the originally scheduled plan. It contains preliminary findings and reports the present status of water planning in the state.

The initial difficulty in the preparation of Phase II was the unavailability of data about the northern 44 counties. Unlike Phase I, which had an abundance of data already available for the southern counties, special studies had to be implemented to gather needed information about the water resources in the northern half of the state.

In the Phase I Plan, Corps of Engineers had for the past ten years studied the possible alternative of moving to central Oklahoma from the southeast area, and they had already compiled a tremendous amount of data.

The same was true with the Bureau of Reclamation studies. We didn't have that advantage going into the Phase II Planning.

Other study problems include the fact that in the Phase I, the reservoirs were there, either existing or authorized, and the water was available and unappropriated. In the northeastern part of the state, there are many existing lakes, but only a small amount of water is available. The water is already obligated to existing beneficial uses, such as, water supply, navigation and hydropower generation. Further, only limited additional good dam sites are available in the northeast section of the state.

Another problem was that the funds provided by the State Legislature to implement the study were inadequate to achieve the stated objectives. Funds available to the Federal agencies assisting in the planning effort were also limited.

In view of these and other problems, a revised planning schedule has been formed. Table 1 on page 2 of the Interim Report shows the schedule. As can be seen, the finished report is to be submitted to the Legislature in January of 1980. No more extensions are possible, so this planning schedule must be strictly adhered to.

Special studies needed to develop information necessary for plan formulation in the northern 44 counties are presently being conducted.

These studies include the Arkansas Basin hydrologic survey, municipal water supply inventories, irrigation inventories, and the updating of our water requirement projections.

A municipal inventory for the northern 44 counties has been completed. 576 towns and 116 rural water districts were surveyed. Information obtained includes present and future expected sources of water quantity, quality, availability, expected longevity, and adequacy. The data are currently being analyzed and recommendations for the short and long-term needs of those communities and rural water districts will be incorporated into the Phase II report.

An inventory of land presently being irrigated was compiled in cooperation with the Soil Conservation Service and O.S.U. Extension Service. The survey indicated that approximately 1,000,000 acres of land are presently being irrigated across the state. Location, type of irrigation system, quantity of water applied per application and the source of energy used were also obtained in this survey.

Perhaps the most important study underway is the hydrologic study being conducted by the Corps of Engineers. This study is important in that it will determine the quantity, quality and location of surplus water

that would be available for distribution to the arid northwest.

All present and future water requirements are being considered in this study including navigation flow requirements for the McClellan-Kerr navigation system, hydroelectric power requirements and interstate compact committments. Diversion concepts being considered include scalping flood flows from existing reservoirs with off-stream holding reservoirs, diverting water directly from the streams and reallocation of storage in existing reservoirs.

When you compare our future water requirement projection with the resources that can be developed locally, we come up with a deficit of about 1½ million acre-feet a year in north central and northwestern Oklahoma. So the 1½ million acre-feet is the amount of water that we're looking for in the hydrologic study.

Studies thus far indicate that direct diversion out of rivers and storing in terminal reservoirs will probably be cost prohibitive because of the large volume of storage required. To obtain the required amount of water for transport it looks like it might require utilizing some of the flows and storage required for hydropower production.

We are looking at several of those alternatives. One is the utilization of all the power storage in a reservoir as a source and replacing the hydropower capability lost with thermal power, such as coal fired plant. Another is the utilization of flows above the firm power generation or the dump power.

The effects of these alternatives on downstream power generation as far as power lost and revenue lost have yet to be determined and are presently being looked at.

Navigation water requirements have been determined to meet the needs of the McClellan-Kerr Arkansas River Navigation System.

The ultimate flow requirement for operation of the navigation system was estimated at 526 cubic-feet per second (cfs) for Robert S. Kerr Lock and Dam. Of this flow, 166 cfs was the assumed leakage loss and 360 cfs was lockage water based on 10 lockages per day. On the Verdigris River portion of the system, a flow of 200 cfs would be required based on 10 lockages and an assumed 30 cfs leakage.

The Bureau of Reclamation is at work out on the receiving end of the water transfer system. They've got land classification studies going to locate areas suitable for long-term project type irrigation. Irrigation benefit analyses are underway using farm budgets developed by Oklahoma State University.

Their conveyance system analyses are nearing completion. They started out in the western end of the panhandle and are working their way to the east

where they will tie into the source system that the Corps will develop. They compare the projected water requirements in an area with the amount of stream water and ground water resources that can be developed locally to determine the deficits. Then on the basis of pumping eleven months out of the year and the most economical design they are sizing canals, pumping plants and terminal reservoirs to meet the deficits. The main conveyance route has been located and they are in the process of laying out the lateral alignment from the main canal to the reservoirs.

Additional studies in eastern Oklahoma are also being conducted to explore all possible aspects of water development in the eastern part of the state. We're calling these area of origin studies. This study is a direct result of a request by southeastern Oklahomans for more in-depth study of the water resources of their area following publication of the Phase I Oklahoma Comprehensive Water Plan. Citizens of this area felt that published water projections for the area were too low and that the Water Plan forecast a no-growth policy for this part of the state. Basically, residents felt the Water Plan would provide no benefits for their area, but rather, the Plan could have detrimental effects on southeastern Oklahoma if regional water was distributed to other parts of the state through a conveyance system.

The purpose of the study is to assure that the needs of the area-of-origin will be met upon construction of a conveyance system and to assure all Oklahomans there is surplus water in southeastern Oklahoma.

Work is being conducted with several eastern Oklahoma based associations concerned with natural resources development. These groups are providing new population estimates and water projections that were developed locally which will be compared with our findings and result in revised figures.

The study will result in a water distribution system for the area of origin and will be incorporated in the State Water Plan.

As I mentioned earlier, there is a piece of legislation currently pending in the Oklahoma legislature which would create an Authority to assure the development of water resources in Oklahoma for many years to come. The bill, SB 625 has been strongly supported by Governor Boren since he feels its passage is imperative if Oklahoma is to continue its steady economic growth.

The bill would create a Water Development Authority which would be able to finance water development projects in Oklahoma, both large and small. The Authority could give loans and grants to towns or large cities for numerous types of water projects, such as, a sewage treatment plant, a rural water system, or an improvement of a municipal water system. The bill would help the people in eastern Oklahoma because even though they have an abundance of water, they need money to develop their distribution

systems. Likewise, western Oklahoma will benefit by the creation of the Authority. The Authority provides a mechanism to contract with the Federal Government for larger projects, such as, the water conveyance system in the future. The financing capability of the Authority is too small to fund the larger projects, but it is a start and can be enlarged.

SB 625 is just the beginning towards a statewide development plan, but by its passage, the people of Oklahoma would be showing that they are concerned about this all-important natural resource and that they care about the future of their state. Also, it would show that we have overcome that old bitterness of East against the West, which has plagued our State for so many years.

The bill successfully passed the Oklahoma Senate earlier this month and was sent to the House of Representatives. The House substantially rewrote the bill to favor the people in Eastern Oklahoma and passed their version just last Wednesday. It will not be reviewed by a Joint Conference Committee composed of members from both the Senate and House. It is our hope at the Water Board that some acceptable compromise will be reached and that if the bill passes it will not have lost its effectiveness.

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